Hagenson, I and J.F. O'Connor, 1981

A Fisheries Inventory of Harrop, Eardley, Weaver and Wrong lakes, 1978

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A Fisheries Inventory of Harrop, Eardley, Weaver and Wrong lakes, 1978.

Manitoba Department of Natural Resources
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ABSTRACT

This study was conducted from July 27, 1978 to August 24, 1978 to determine the sport fish potential of Harrop, Eardley, Weaver and Wrong lakes and to provide baseline data to permit recommendations for improving recreational fishing opportunities. All of the study lakes are eutrophic headwater lakes with potential for high quality recreational fisheries.

The lodges and outcamps on Harrop, Eardley and Wrong lakes have had no major adverse effect on the sport fish populations of these lakes.

Weaver Lake is a relatively large shallow lake which has potential for good sport fishing for walleye if, developed as an outcamp or day use lake.

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INTRODUCTION

Harrop, Eardley, Weaver and Wrong lakes are presently accessible only by aircraft or canoe. This relative isolation will eventually change as an expanding transportation network penetrates further into the area east of Lake Winnipeg.

The remote nature of the lakes on the east side of Lake Winnipeg ensures relatively light public angler pressure. The results of the angling licence questionnaire in 1972 show 8.5 percent of resident Manitoba anglers, 1.5 percent other Canadian anglers and 6.9 percent of U.S. resident anglers journey into the area east of Lake Winnipeg to fish. Most of these anglers would be guests of lodges in the area. If the provincial angler distribution has remained unchanged since the survey, approximately 13,000 anglers exerted 167,547 fishing days in this area in 1978.

Harrop and Wrong lakes both have fishing lodges with capacities of 16 and 24 beds respectively. In addition to the fishing lodges on these lakes there are 7 private cabins on Harrop Lake and an 8 bed outcamp on Wrong Lake. Eardley Lake also has an 8 bed outcamp located on it, with 3 private cabins. Weaver Lake has only 2 private camps located on it.

This study was conducted from July 27, 1978 to August 24, 1978. The objectives were to determine the sport fish potential of the lakes, assess the effects of lodge development on Harrop and Wrong lakes and provide baseline data to permit recommendations for improving recreational fishing opportunities from the lakes.

The study area

Harrop, Eardley, Weaver and Wrong lakes are located on the Poplar River system approximately 300 kilometers northeast of Winnipeg (Fig. 1). Their locations by latitude (N) and longitude (W) are as follows:

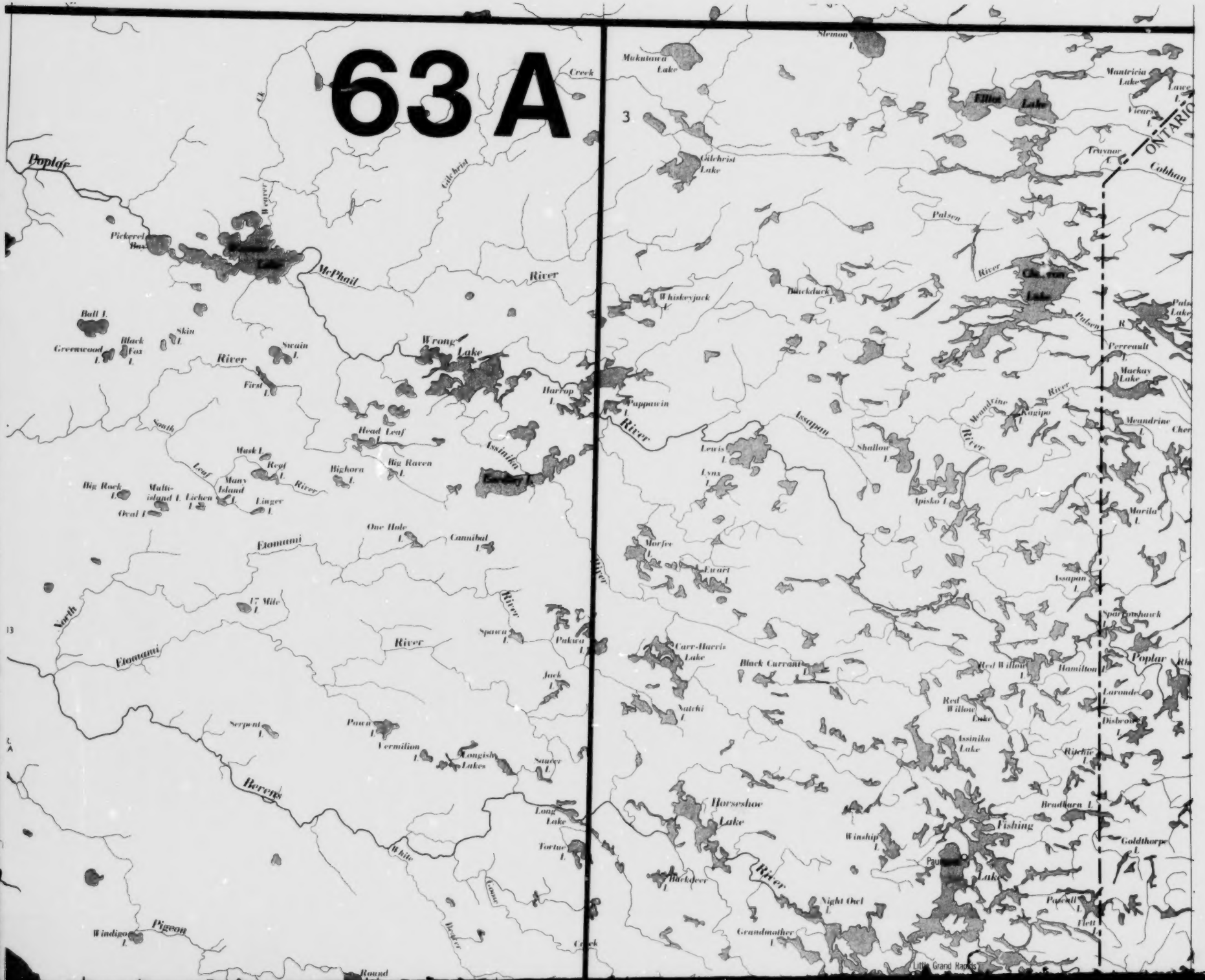
Harrop	52° 38'	96° 00'
Eardley	52° 32'	96° 06'
Weaver	52° 45'	96° 35'
Wrong	52° 38'	96° 12'

All of the lakes are located on the Precambrian Shield. The topography of the area is Precambrian drift plain of a rolling to hilly nature. The surface deposits of the area consist of varying amounts and thicknesses of glacial drift with abundant rock outcrop. Bogs and lakes cover 40 to 60 percent of the surface (Weir, 1960). A more complete description of the geology and soil composition of the area may be obtained from Dutchak et al.(1978).

The natural vegetation of the area is northern coniferous forest consisting mainly of black spruce (*Picea mariana*), white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*). There is jackpine (*Pinus banksiana*) with white birch (*Betula papyrifera*) and balsam poplar (*Populus balsamifera*) in areas of recent burns (Weir, 1960).

The principal species of emergent vegetation in these lakes were yellow water lily (*Nuphar variegatum*), floating leaf pondweed (*Potamogeton natens*), arrowhead (*Sagittaria cuneata*), bulrush (*Scirpus* sp), wild rice (*Zizania aquatica*) and reed grass (*Phragmites communis*).

Harrop, Eardley, Weaver and Wrong lakes are all headwater lakes of the Poplar River. The drainage basins vary in size from 712 sq. km at Eardley Lake to 1184 sq. km at Weaver Lake. Harrop and Wrong lakes both have


63 A
ONTARIO
Poplar
Pickerel Box
McPhail
River
Ball I.
Greenwood I.
Black Fox I.
Skin L.
Swain L.
Wrong Lake
First L.
Harrop I.
Pappawin I.
South
Leaf
River
Mask I.
Reef I.
Bighorn I.
Big Raven L.
Issinika
Big Rock I.
Multi-island L.
Lichen I.
Many Island
Linger I.
Oval I.
Etomami
One Hole L.
Cannibal I.
17 Mile I.
North
Spawn I.
Pakwa I.
Jack I.
Serpent I.
Pawn I.
Vermilion I.
Longish Lakes
Saucer I.
Berens
Long Lake
Tartue I.
Hy Hite
Pigeon
Windigo I.
Round
Creek
Gilchrist
Mukutawa Lake
Slemon I.
Gilchrist Lake
Whiskeyjack
Blackduck I.
Palsen
Lewis I.
Lynx I.
Issapan
Shallow I.
Apisko I.
Morfee I.
Ewart I.
Carr-Harris Lake
Black Currant I.
Natchi I.
Horseshoe Lake
Backdeer I.
Night Owl I.
Grandmother I.
Little Grand Rapids
Elliot Lake
Mantricia Lake
Vicars I.
Trevanor
Cobham
Meandrine
Kagipo I.
Perreault I.
Mackay Lake
Marita I.
Sparrowhawk I.
Red Willow I.
Red Willow Lake
Assinika Lake
Hamilton I.
Laronde I.
Disbrow I.
Ritchie I.
Bradburn L.
Fishing
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Pauskeli I.
Flett I.
Lake
3
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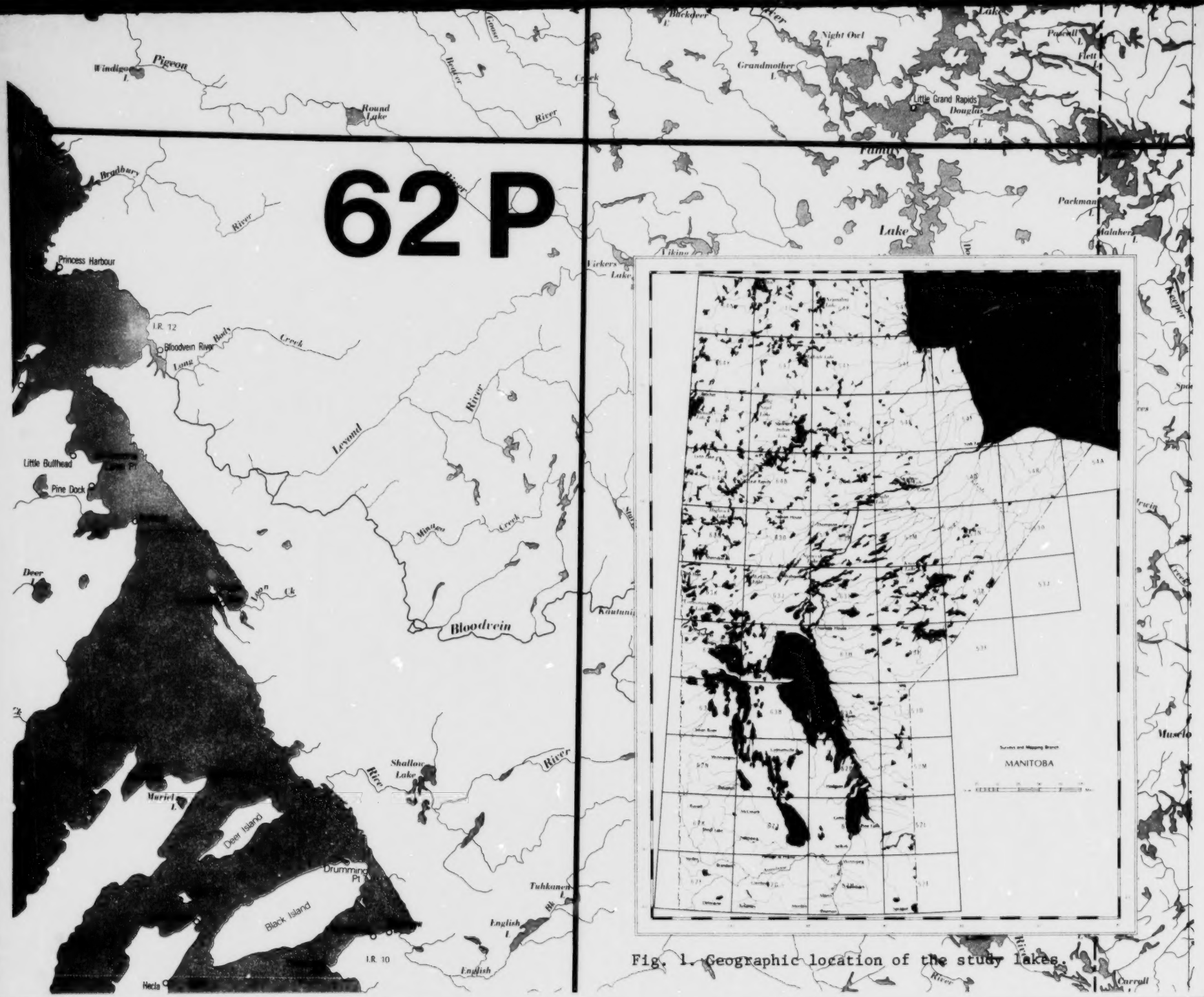

Fig. 1. Geographic location of the study lakes.

a drainage basin area of approximately 720 sq. km.

The main inflow of Harrop Lake is the Poplar River. Two branches of the Poplar enter the lake on the south side. There are two small inflows in the southeastern bay of Harrop Lake which drain small outlying lakes. The main outflow is the Poplar River. Another outflow located on the northeastern arm of the lake connects with Wrong Lake.

The Assinika River is the main inflow of Eardley Lake. There is another small inflow on the south side which drains a small outlying lake in a bog area. The only outflow is the Assinika River which joins the Poplar River at the inlet of Wrong Lake.

Wrong Lake has two main inflows, the major one being the Poplar River. The other drains from Harrop Lake and enters the northeastern bay. There are also two small inflows on the south shore which drain small lakes and bog areas. The only outflow is the Poplar River which drains to Weaver Lake.

The main inflow of Weaver Lake is the Poplar River. Another inflow is Weaver Creek which enters the lake on the north shore. There are two small inflowing creeks on the south side and one on the north side which drain small outlying lakes and bog areas. A small inflowing creek on the south side is actually a branch of the Poplar River. The only outflow is the Poplar River.

METHODS

The number of depth-sounding transects varied with each lake and was determined by the complexity of the lake basin. The depth sounding in this survey was done with a Furuno FG 200 MK3 unit with a range of 0 to 87 meters. The unit was attached to a 4.3 meter inflatable boat powered by a 20 horsepower outboard. The locations of the transects were drawn on a work map prior to sounding. Some of the transects were later modified after substituting more prominent landmarks for start and stop points.

The number of chemical stations was not fixed and varied according to the complexity of the lake basin and the location of inflowing streams. At the chemical stations complete sets of data including temperature, dissolved oxygen, conductivity and pH were recorded. The water temperature and dissolved oxygen profiles were recorded at one meter intervals from the surface to the bottom with a YSI electronic instrument.

The transparency of the water was measured with a standard limnological Secchi disc, according to Welch (1948).

The conductivity was measured with a YSI electronic instrument at the surface.

The pH at each station was measured with a Hach wide range colour comparator field kit.

There were two water collection stations per lake. Three, one liter samples were collected from each station. One was fixed with 2.5 ml nitric acid (50%). The samples were then frozen and submitted at a later date for analysis. The analyses of the water samples were done by the Environmental Management Division of the Department of Consumer and Corporate Affairs and Environment.

Plankton samples were collected at chemical station sites with a 25 cm Wisconsin plankton tow of 73 micron Nitex. In addition, plankton samples were also collected from all areas of emergent vegetation with a long handle plankton sweep net also of 73 micron Nitex. The samples were preserved in the field in 10% formalin for identification and analysis at a later date.

Benthic samples were collected from each station with a 15 cm by 15 cm Ekman dredge. The samples were washed in the field in a 400 micron Nitex bag and preserved in 10% formalin for later identification and analysis.

Small fish specimens (forage fish) were collected by seining a suitable area with a 1.2 m by 7.4 m minnow seine of 6 mm oval mesh. This was supplemented with samples collected by the fish toxicant, rotenone. A small bay or area of the lake was selected, preferably one that could be blocked off with the seine, and rotenone was then gradually dispensed into the water in the prop wash. It was thoroughly mixed into the water by traversing the treated area by boat several times.

The intensity of standard gang gill net sampling was predetermined at one set per 200 hectares of surface area. This figure then was subjectively varied according to the complexity of lake morphometry. Ten net sets were made in Harrop Lake, 14 in Eardley Lake and 16 in each of Weaver and Wrong lakes. The standard gang was comprised of six nets of different mesh sizes, each being 22.9 m in length and 1.8 m deep. The mesh sizes were randomized as 3.8 cm, 9.5 cm, 5.1 cm, 10.8 cm, 7.6 cm and 12.7 cm. The net sets were rotated about the lake to sample as many different habitat types and depth zones as possible.

The sport species, walleye (*Stizostedion vitreum*) and northern pike (*Esox lucius*) were sampled for fork length, weight, sex, maturity and stomach contents. For age determination, the otoliths and first two dorsal rays were taken from the walleye and the first two pelvic rays were taken from the northern pike. All other species of fish were sampled for fork length and weight only. Age determination of the calcified structures was achieved by sectioning the structures and reading the annuli under high power magnification on a microfiche reader.

Calculations

The morphometric calculations such as length of lake shoreline, island shoreline length, total surface area and area of each depth contour were determined according to Hutchinson (1957).

The morphoedaphic index (MEI) was calculated according to Ryder's (1965) formula for moderately to intensively fished lakes.

Regression analyses were calculated according to Snedecor and Cochran (1967).

The mean weighted age of onset of sexual maturity was calculated according to Abrosov (1967).

RESULTS

Drainage Divisions

The watershed divisions of Manitoba that contain the lakes surveyed are summarized in Table 1. Also shown is the area of each watershed unit (Fedoruk, 1970).

Bathymetric mapping

The basin configuration of the study lakes was quite diverse. The shoreline development index of the lakes ranged from 1.8 on Harrop Lake (Fig. 2) to 4.5 on Wrong Lake (Fig. 5). The shoreline development indices of Eardley and Weaver lakes were 3.6 and 3.7 respectively (Figs. 3 and 4).

Other salient morphometric features such as area and mean depth are summarized in Table 2.

Physical and chemical parameters

The secchi transparencies of the study lakes were very close. The values ranged from 1.0 m in Weaver on August 16 to 1.2 m in Wrong on August 9 to 1.3 m in Eardley and Harrop on August 16 and 17.

Wrong Lake had the lowest pH recorded at 6.9. The remaining lakes had a pH of 7.0.

Table 1. Drainage divisions and watershed units of Manitoba that contain the study lakes.

Principal drainage division			Major drainage division			Watershed unit			
Number	Name	Approx. area in Manitoba in sq. km.	Number	Name	Approx. area in Manitoba in sq. km.	Number	Name	Approx. area in Manitoba in sq. km.	Lake
5	Nelson River	1,061,900	5RE	Poplar River Division	9,705	5RE-E	Harrop Lake region	720	Harrop
						5RE-I	Assinika River	712	Eardley
						5RE-B	Poplar River lower region	1,184	Weaver
						5RE-E	Harrop Lake region	720	Wrong

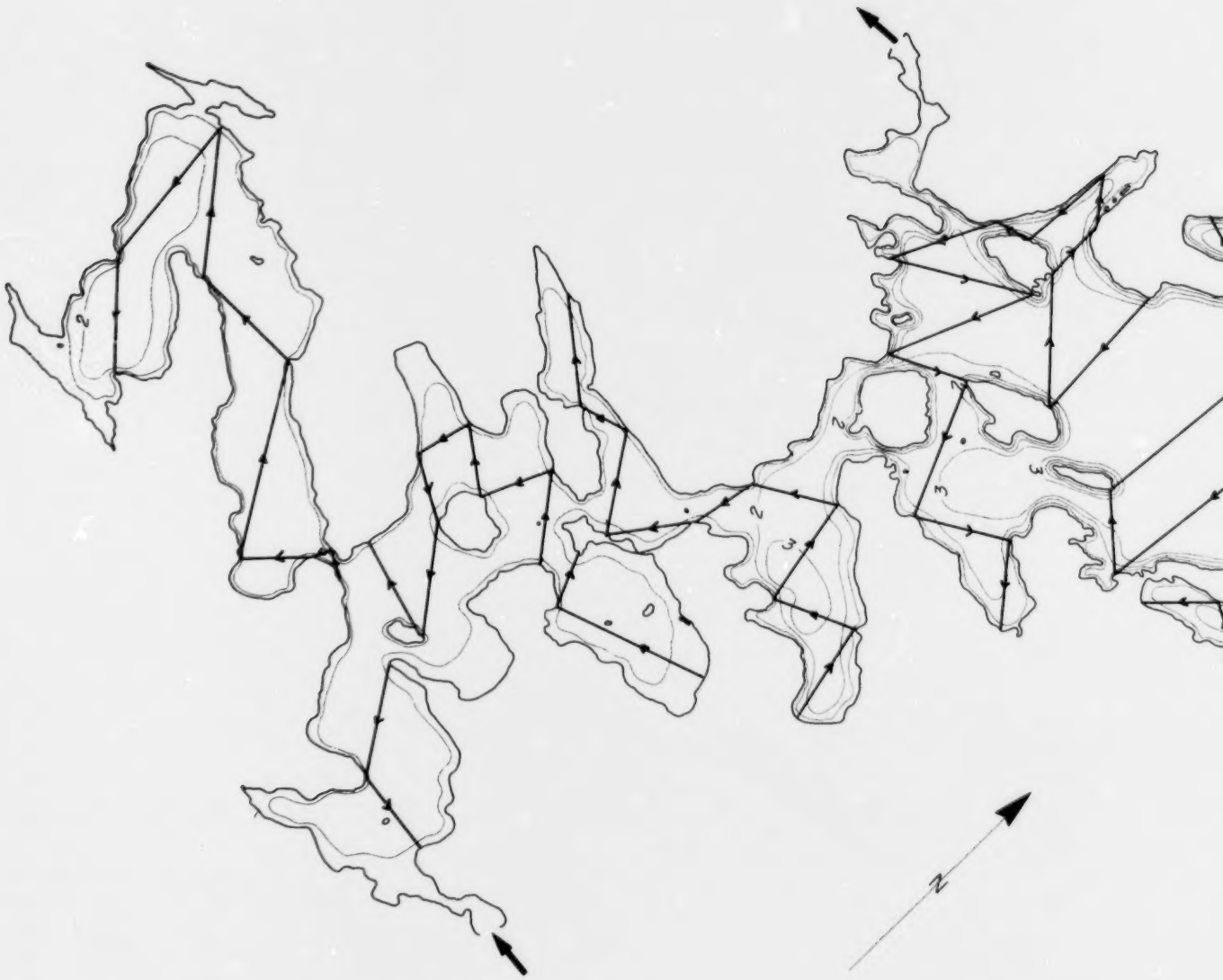

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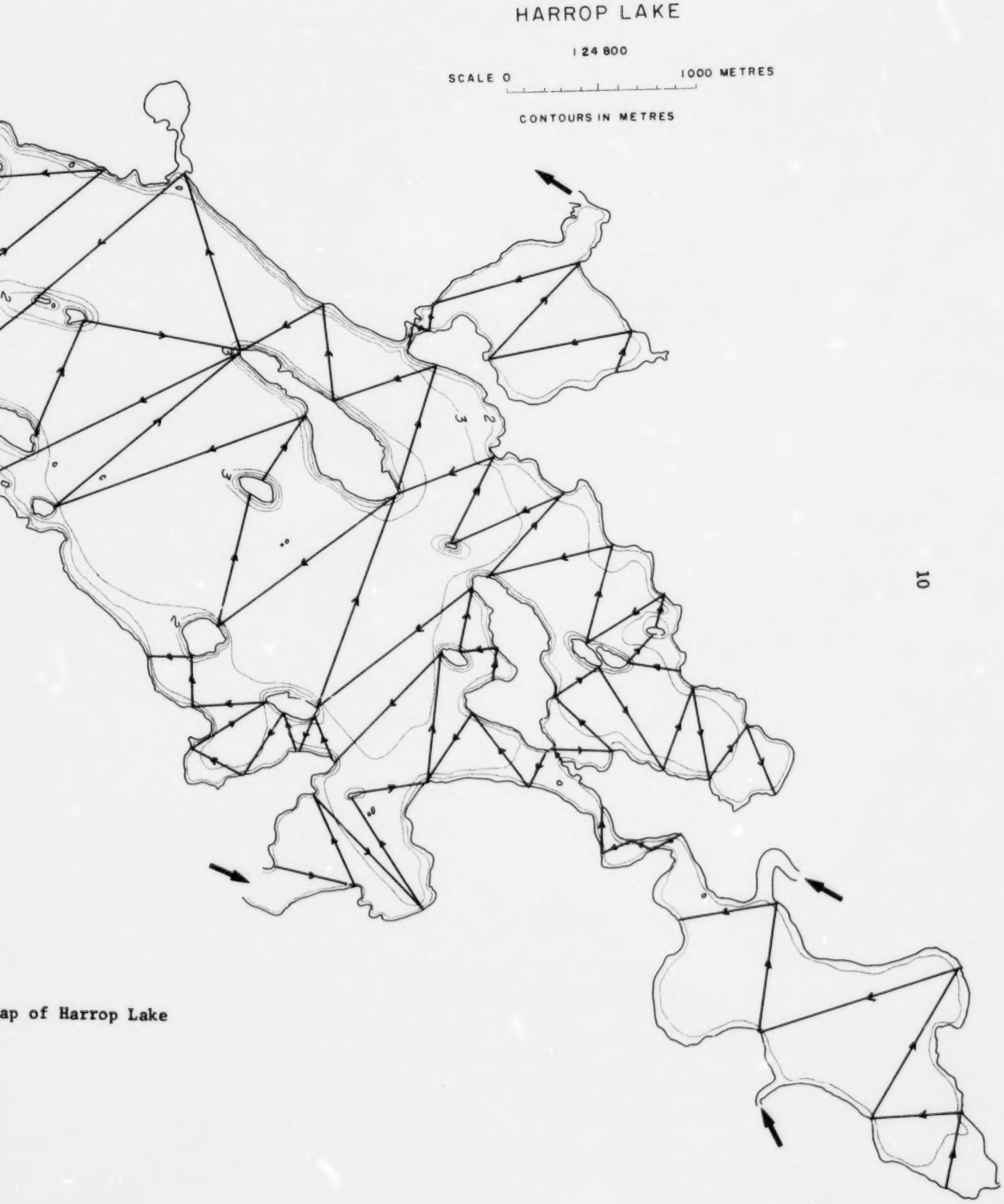
Fig. 2. Bathymetric



ap of Harrop Lake

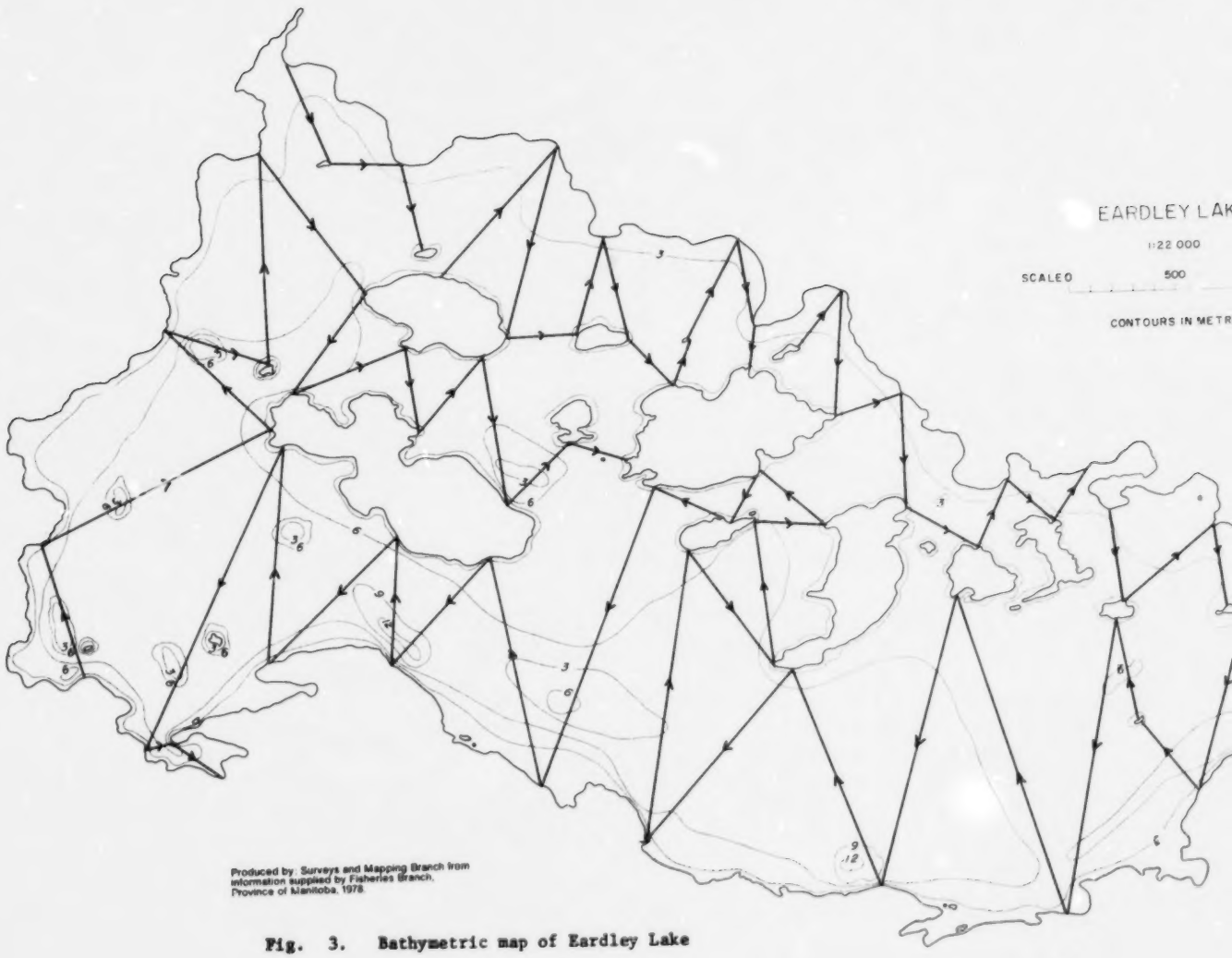

EARDLEY LAK
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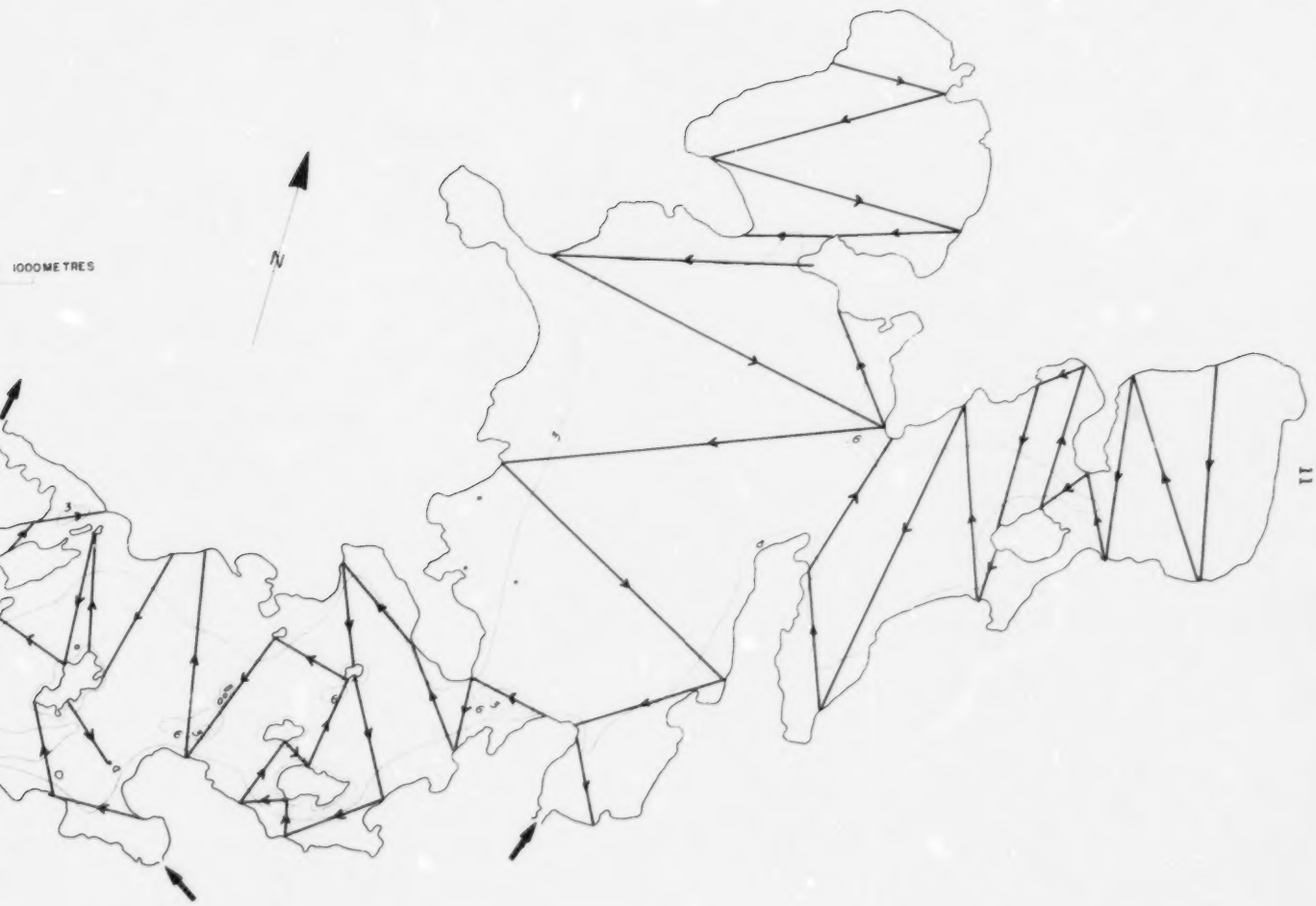
Fig. 3. Bathymetric map of Eardley Lake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WEAVER LAKE

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CONTOURS IN METRES

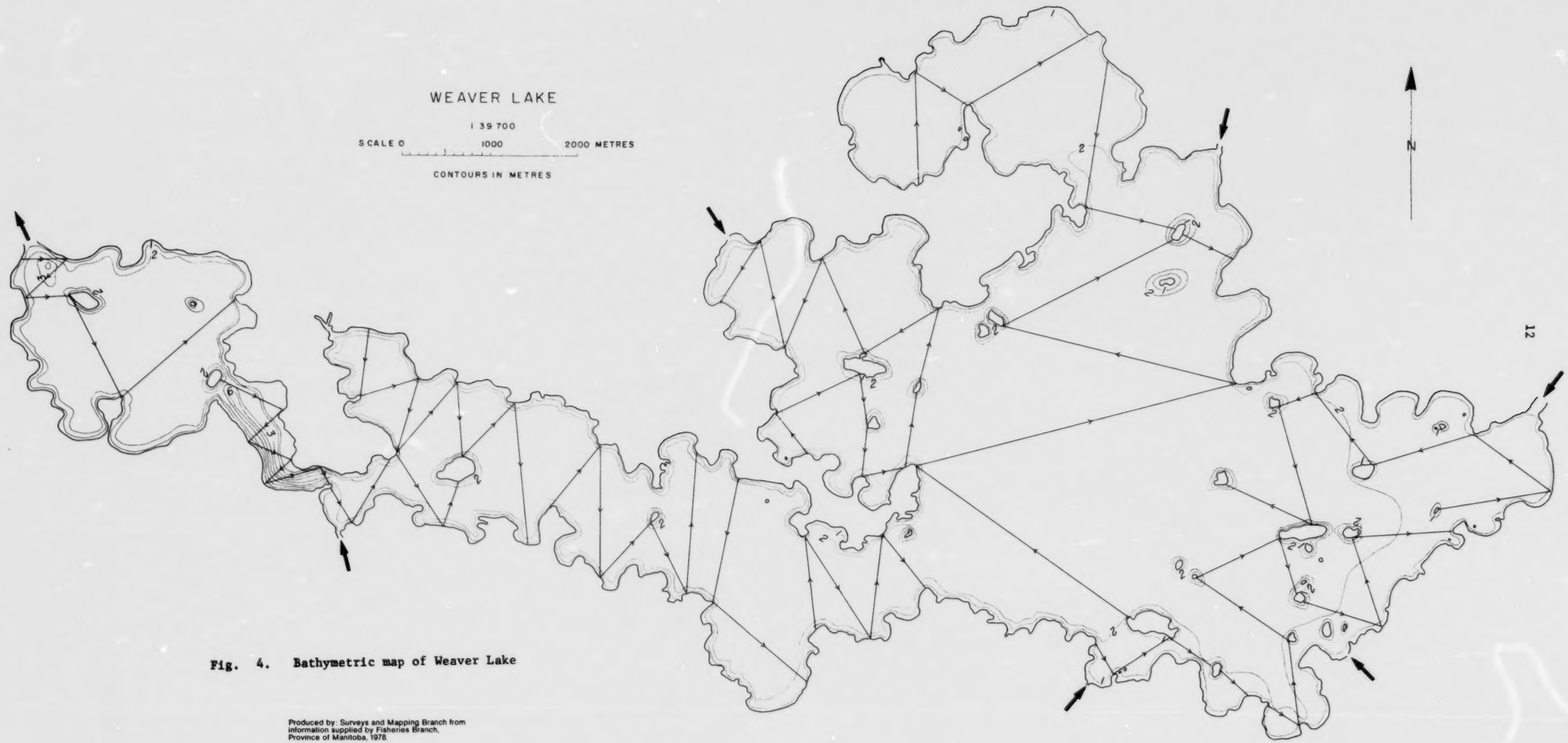

Fig. 4. Bathymetric map of Weaver Lake

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WRONG LAKE

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SCALE 0 500 1000 METRES

CONTOURS IN METRES

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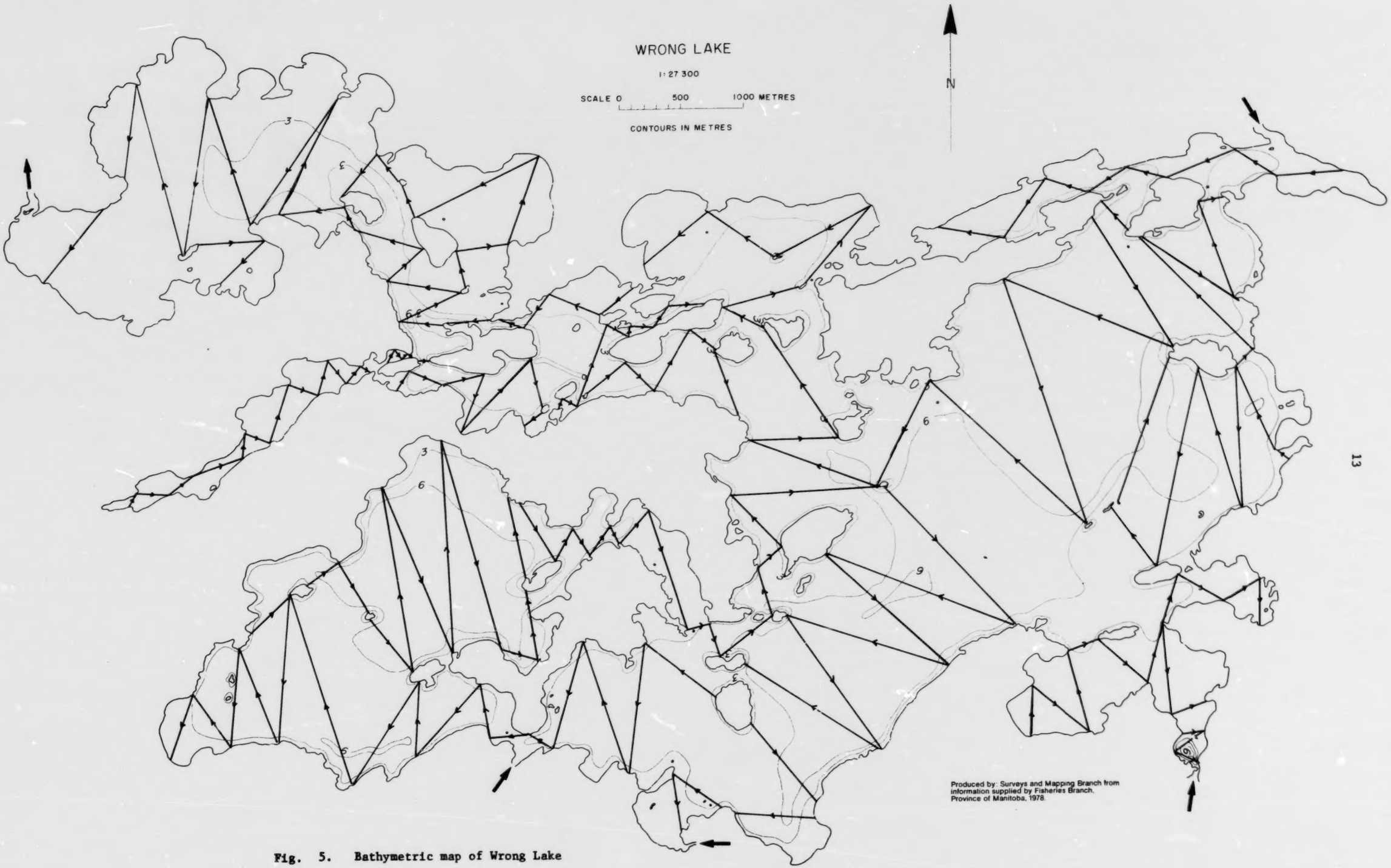

Fig. 5. Bathymetric map of Wrong Lake

Table 2. Basin size, capacity and configuration of Harrop, Eardley, Weaver and Wrong lakes.

	Harrop	Eardley	Weaver	Wrong
Area (ha)	1590	1889	5694	3320
Maximum depth (m)	3	12	6	9
Mean depth (m)	2.1	4.0	2.0	3.7
Volume ($m^3 \times 10^6$)	34.1	75.9	115.0	124.1
Length of shoreline (km)	70.4	55.2	100.0	93.0
Length of island shoreline (km)	15.6	23.9	15.9	34.0
Total length of shoreline (km)	86.0	79.1	115.9	127.0

Temperature - dissolved oxygen profiles of the study lakes are presented in Fig. 6. The results indicated that each of the lakes was isothermal with saturated levels of dissolved oxygen from the surface to the bottom. The locations of the sampling stations are presented in Figs. 7 to 10.

Dissolved minerals in the study lakes were dominated by bicarbonates (Table 3). The total dissolved solids ranged from 49.0 mg/l in Eardley to 77.0 mg/l in Wrong. Harrop and Weaver lakes had total dissolved solids of 51.0 mg/l and 58.5 mg/l respectively.

The nutrient concentrations of the lakes were quite low. The dissolved nitrogen, nitrites and nitrates ranged from <0.01 mg/l in Wrong to 0.51 mg/l in Harrop.

The total phosphorus concentrations were also low ranging from <0.02 mg/l in Harrop Lake to 0.03 mg/l in Weaver Lake (Table 3).

Bottom Fauna

The benthic organisms collected from the lakes during this survey are summarized in Appendix 1. The locations of the collection sites are shown in Figs. 7 to 10.

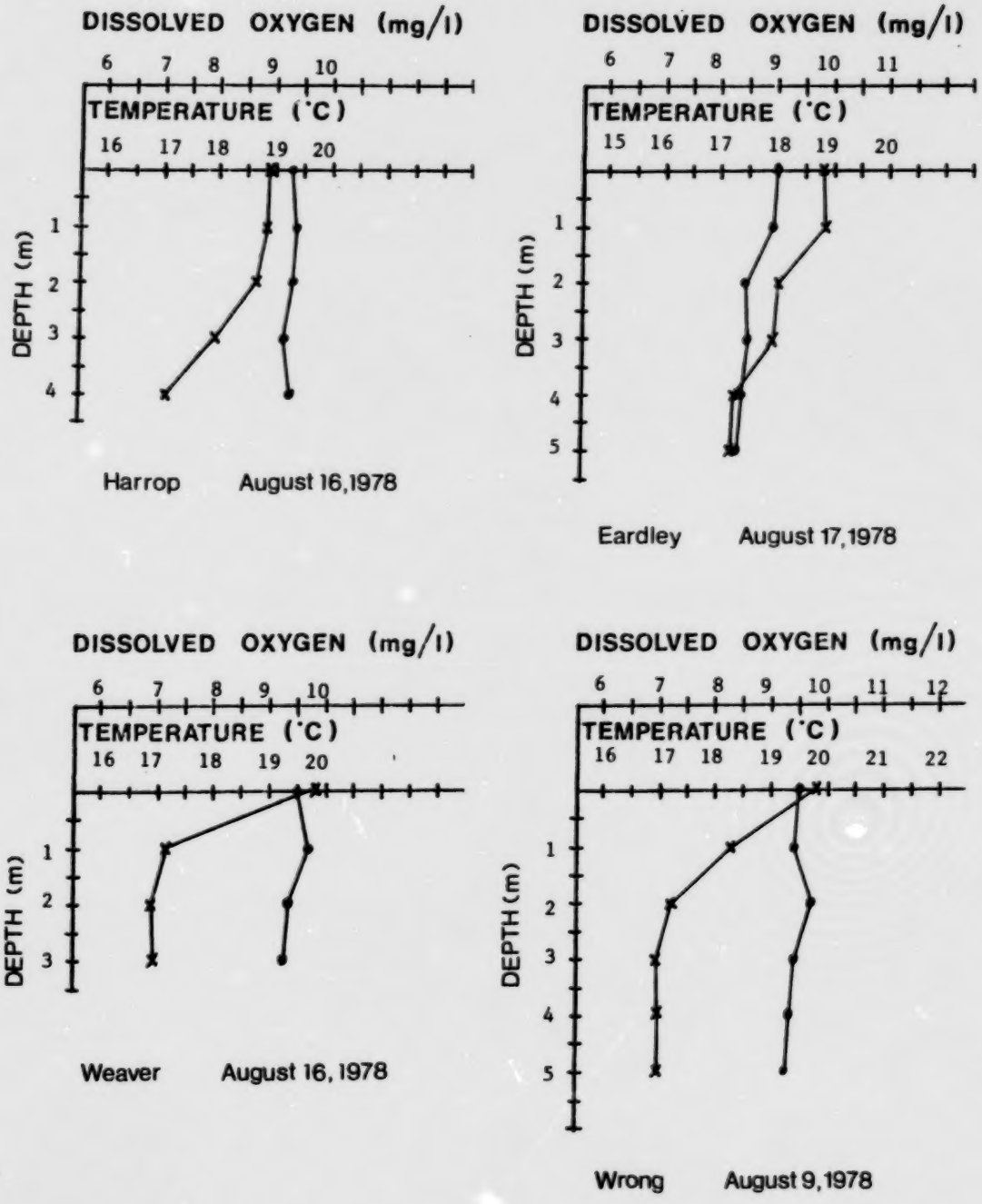

Fig. 6. Temperature x—x dissolved oxygen •—• profiles of Harrop, Eardley, Weaver and Wrong lakes.

LEGEND

Δ Water Sample Stations

▲ Chemical Stations

Gill Net Sets

Small Fish Collection Si

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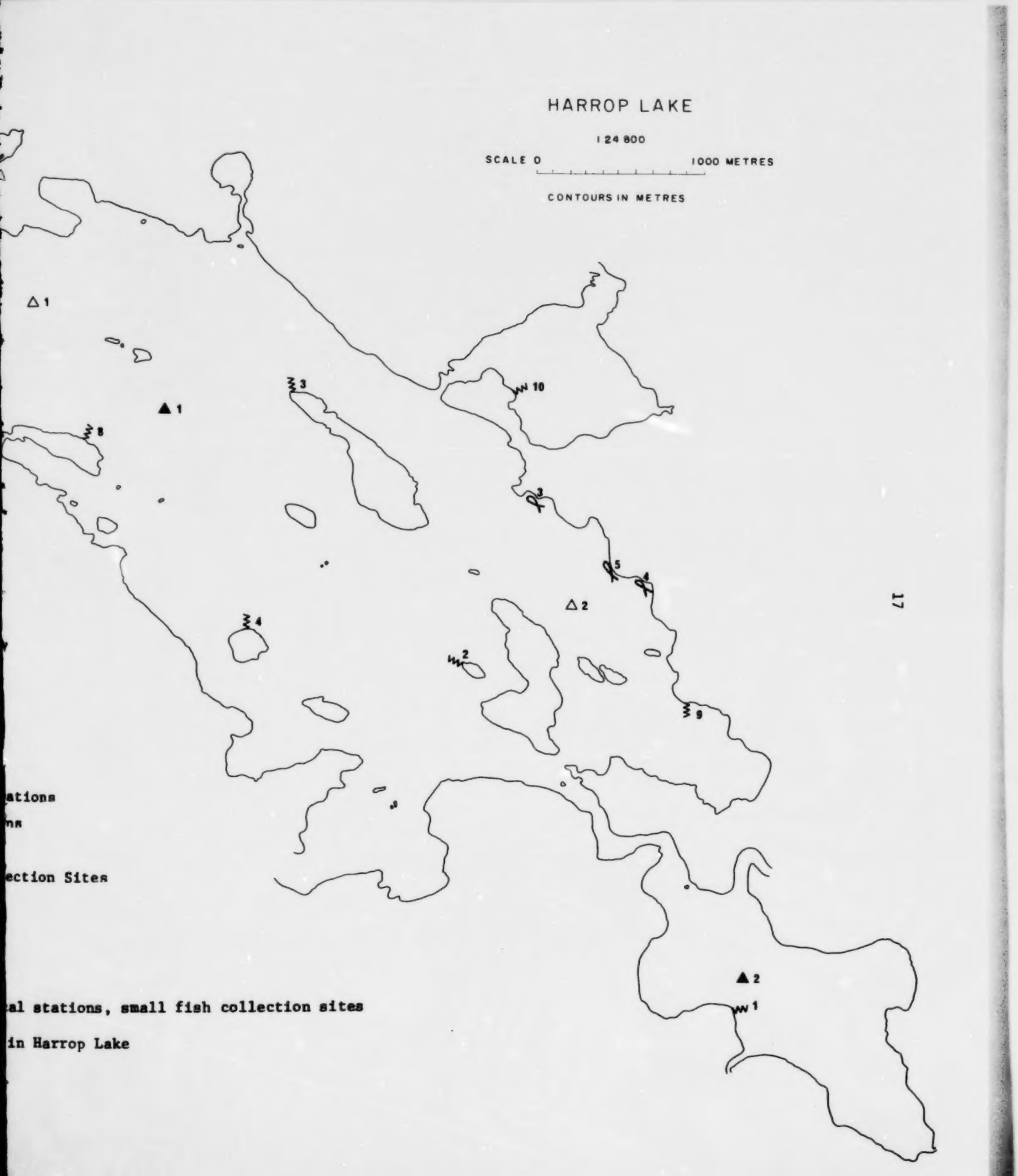
Fig. 7. Location of chemical static
and gill net sets in Harrop



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ection Sites

al stations, small fish collection sites
in Harrop Lake

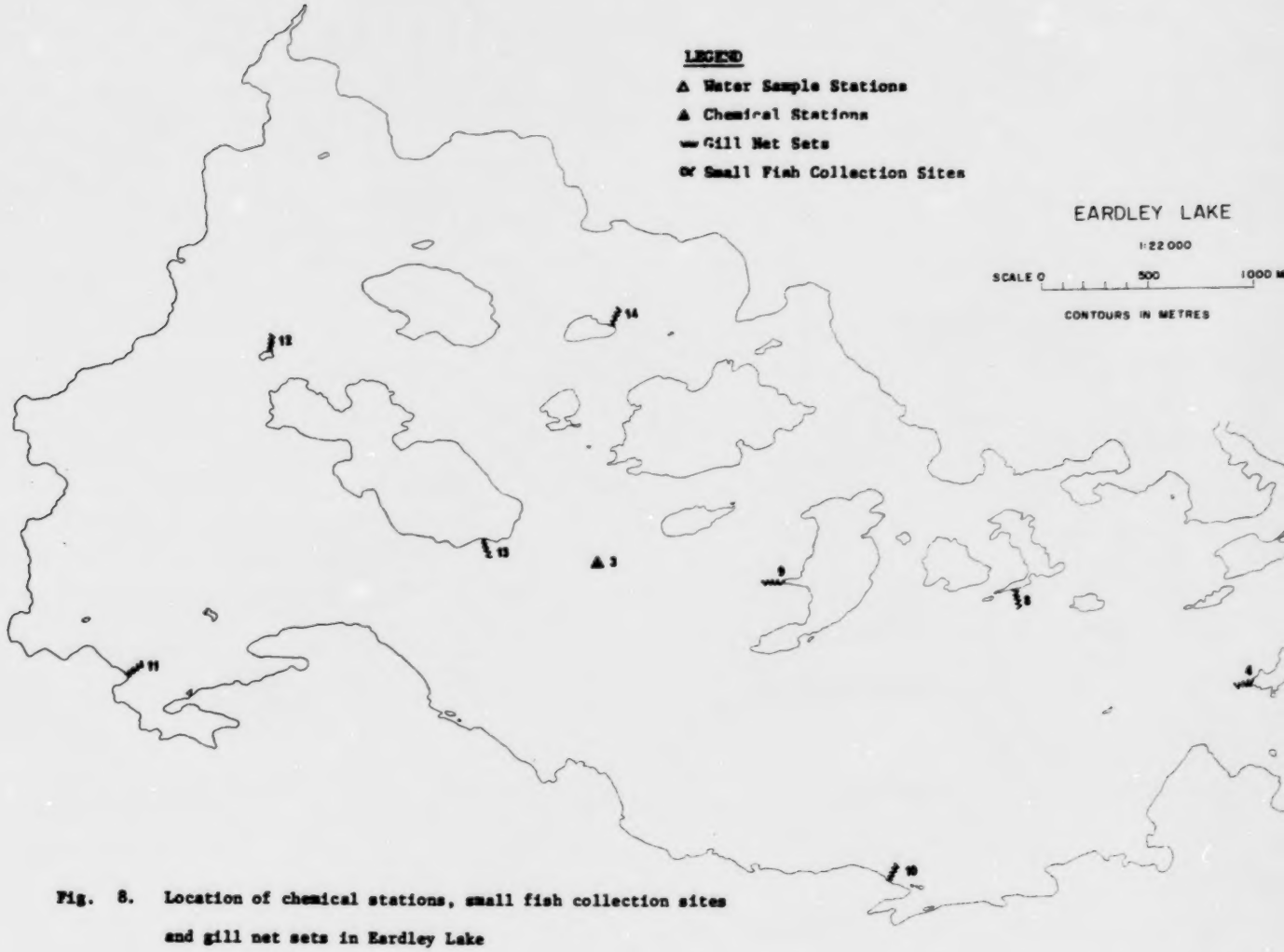

Fig. 8. Location of chemical stations, small fish collection sites and gill net sets in Eardley Lake

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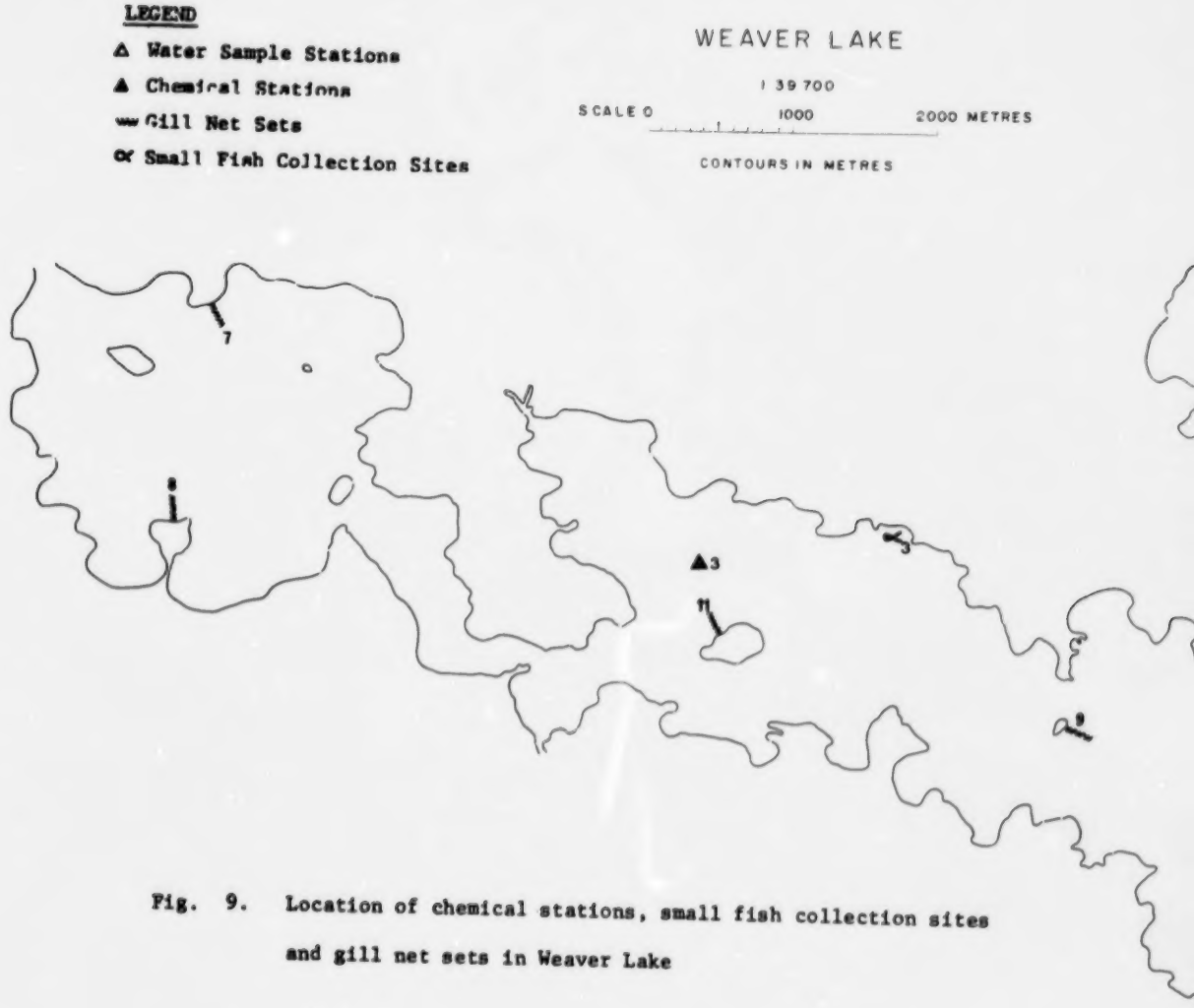

Fig. 9. Location of chemical stations, small fish collection sites and gill net sets in Weaver Lake

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N
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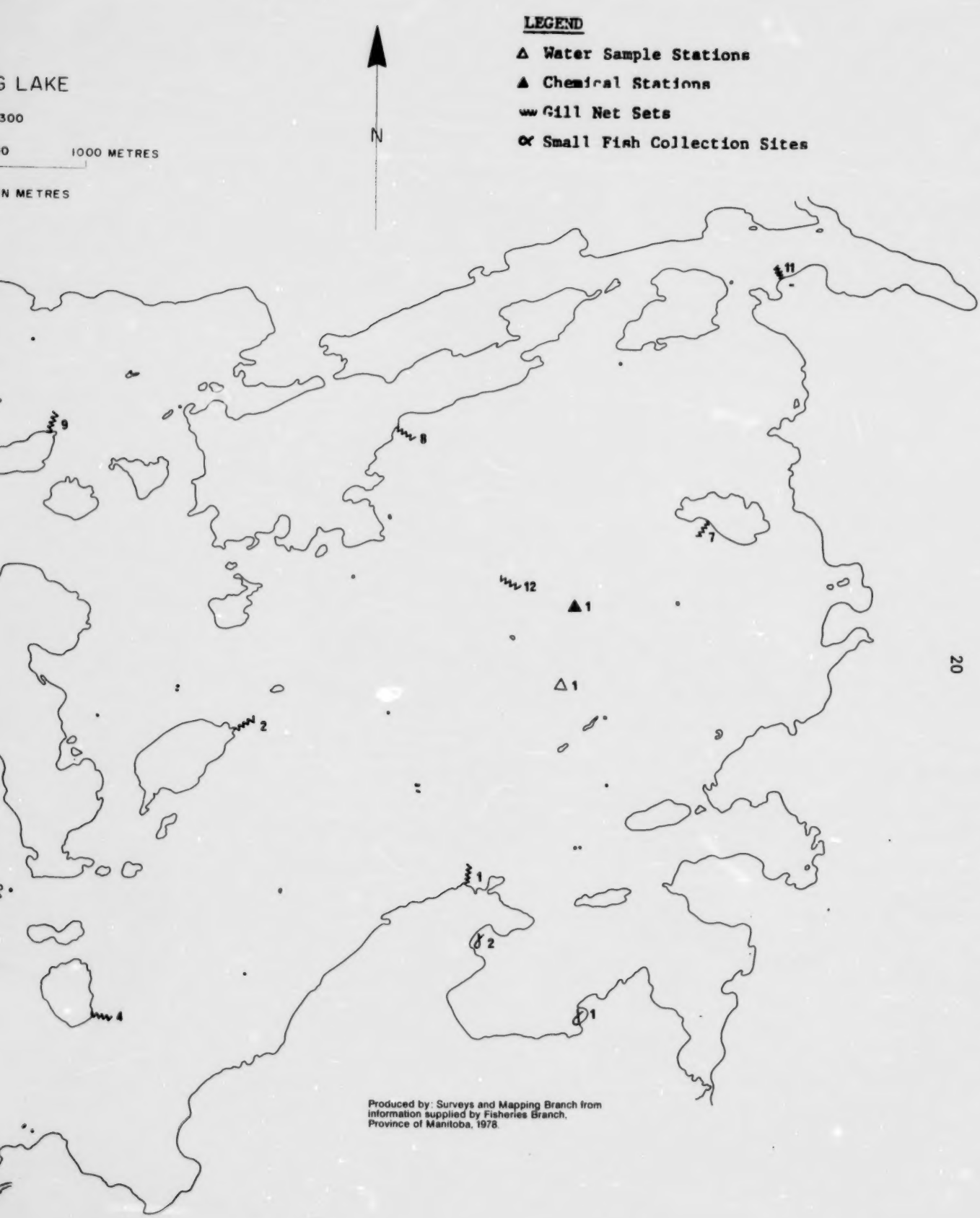
15

Fig. 10. Location of chemical
and gill net sets in



stations, small fish collection sites

Wrong Lake

Table 3. Water chemistry analysis of Harrop, Eardley, Weaver and Wrong lakes, August, 1978.

Parameter	Harrop	Eardley	Weaver	Wrong
Conductivity (µmho/cm)	30.25	33.80	35.75	32.45
Residue Total (mg/l)	57.00	57.00	71.00	77.00
Residue Filterable (mg/l)	51.00	49.00	58.50	71.00
Non-filterable Residue (mg/l)	6.00	8.00	12.50	6.00
Ca (Ext) mg/l	<5.00	<5.00	<5.00	<5.00
Mg (Ext) mg/l	<5.00	<5.00	<5.00	<5.00
Hardness ($CaCO_3$) mg/l	16.00	16.00	19.50	16.00
K (Ext) mg/l	<2.00	<2.00	<2.00	<2.00
Na (Ext) mg/l	<10.00	<10.00	<10.00	<10.00
Colour (true hazen units)	>50.00	>50.00	>50.00	>50.00
Turbidity NTU	1.50	2.00	2.75	2.25
NO_3-NO_2-N (Diss) mg/l	.51	.11	.32	<.01
P Total mg/l	<0.2	.02	.03	.02
Cl (sol) mg/l	<2.00	<2.00	<2.00	<2.00
SO_4 (sol) mg/l	10.00	5.00	12.50	5.00

Plankton

Plankton specimens collected from Harrop, Eardley, Weaver and Wrong lakes are summarized in Appendix 2. The locations of the collection sites are illustrated in Figs. 7 to 10.

Small fish collection

There were fifteen species of forage fish collected from Harrop, Eardley, Weaver and Wrong lakes. Of these the most numerous were yellow perch (*Perca flavescens*) and spottail shiners (*Notropis hudsonius*). The results are summarized in Table 4 and the locations of the collection sites are shown in Figs. 7 to 10.

Large fish collection

Fifty-six net sets were made in the study lakes. The yields of these sets are summarized in terms of number and weight per mesh size, in Tables 5 to 8. The locations of the individual net sets are illustrated in Figs. 7 to 10. The predominant sport species captured by the gill nets was walleye. They comprised close to 50 percent of the total catch from each of the study lakes.

Table 4. Small fish collected from Harrop, Eardley, Weaver and Wrong lakes.

Species	Harrop	Eardley	Weaver	Wrong
Burbot (*Lota lota*)	*	*	*	*
White sucker (*Catostomus commersoni*)	*	*	*	*
Emerald shiner (*Notropis atherinoides*)	*		*	
Log perch (*Percina caprodes*)		*	*	
Northern pike (*Esox lucius*)	*	*	*	*
Rock bass (*Ambloplites rupestris*)				*
Longnose dace (*Rhinichthys cataractae*)			*	
Slimy sculpin (*Cottus cognatus*)	*	*	*	
Spottail shiner (*Notropis hudsonius*)	*	*	*	*
Trout perch (*Percopsis omiscomaycus*)	*	*		*
Walleye (*Stizostedion vitreum*)	*	*	*	*
Yellow perch (*Perca flavescens*)	*	*	*	*
Mimic shiner (*Notropis vollucellus*)	*	*	*	*
Johnny darter (*Etheostoma nigrum*)	*			*
Bluntnose minnow (*Pimephales notatus*)				*

Table 5. Gill net summary Harrop Lake.

Species		Mesh Size (cm) 3.81	5.08	7.62	9.52	10.79	12.70	Total	%
Walleye	No.	24	58	85	19	19	7	243	41.0
(*Stizostedion vitreum*)	kg.	10.3	21.6	52.3	35.8	15.6	7.1	142.7	
Northern pike	No.	9	22	24	7	-	1	63	10.6
(*Esox lucius*)	kg.	2.9	21.6	40.8	5.6	-	4.5	75.4	
Sauger	No.	4	29	5	2	-	-	40	6.8
(*Stizostedion canadense*)	kg.	0.9	6.8	1.7	0.5	-	-	9.9	
Mooneye	No.	1	-	27	15	7	-	50	8.4
(*Hiodon tergisus*)	kg.	0.2	-	11.4	6.2	3.3	-	21.1	
Shorthead redhorse	No.	-	2	3	13	9	-	27	4.6
(*Moxostoma macrolepidotum*)	kg.	-	2.4	3.2	18.3	14.2	-	38.1	
White sucker	No.	1	5	6	13	7	5	37	6.2
(*Catostomus commersoni*)	kg.	0.1	2.8	5.2	13.6	8.4	7.6	37.7	
Tullibee	No.	-	16	11	11	9	-	47	7.9
(*Coregonus artedii*)	kg.	-	3.1	4.8	6.2	4.1	-	18.2	
Yellow perch	No.	35	37	11	2	-	-	85	14.5
(*Perca flavescens*)	kg.	3.3	5.1	2.5	0.4	-	-	11.3	
TOTAL	No.	74	169	172	113	51	13	592	
	kg.	17.7	63.4	121.9	86.6	45.6	19.2	354.4	

Table 6. Gill net summary Eardley Lake.

Species		Mesh Size (cm) 3.81	5.08	7.62	9.52	10.79	12.70	Total	%
Walleye (*Stizostedion vitreum*)	No.	24	46	97	66	34	5	272	53.6
	kg.	13.3	20.1	64.7	47.5	33.2	6.8	185.6	
Northern pike (*Esox lucius*)	No.	8	10	31	10	4	3	66	13.0
	kg.	15.2	37.2	56.4	21.9	7.0	7.5	145.2	
Whitefish (*Coregonus clupeaformis*)	No.	-	-	-	3	6	-	9	1.8
	kg.	-	-	-	2.7	6.9	-	9.6	
Shorthead redhorse (*Moxostoma macrolepidotum*)	No.	-	-	1	-	2	3	6	1.2
	kg.	-	-	1.2	-	2.6	4.4	8.2	
White sucker (*Catostomus commersoni*)	No.	-	1	4	5	8	2	20	3.9
	kg.	-	0.1	4.2	4.9	11.5	3.3	24.0	
Tullibee (*Coregonus artedii*)	No.	9	34	28	9	6	-	86	16.9
	kg.	1.4	4.4	7.9	3.3	3.2		20.2	
Yellow perch (*Perca flavescens*)	No.	27	15	6	-	-	-	48	9.6
	kg.	1.3	1.6	1.3	-	-	-	4.2	
TOTAL	No.	68	106	167	93	60	13	507	
	kg.	31.2	63.4	135.7	80.3	64.4	22.0	397.0	

Table 7. Gill net summary Weaver Lake.

Species		Mesh Size (cm) 3.81	5.08	7.62	9.52	10.79	12.70	Total	%
Walleye	No.	78	140	257	99	23	2	599	41.4
(*Stizostedion vitreum*)	kg.	24.3	60.5	110.2	48.0	14.8	0.8	258.6	
Northern pike	No.	13	12	29	8	16	6	84	5.8
(*Esox lucius*)	kg.	26.1	16.0	49.8	31.3	42.1	20.2	185.5	
Sauger	No.	9	15	10	3	-	-	37	2.6
(*Stizostedion canadense*)	kg.	2.6	4.7	3.3	1.0	-	-	11.6	
Whitefish	No.	-	2	1	-	3	1	7	0.5
(*Coregonus clupeaformis*)	kg.	-	2.9	1.0	-	3.1	1.0	8.0	
White sucker	No.	-	4	31	36	44	12	127	8.8
(*Catostomus commersoni*)	kg.	-	4.1	29.4	35.8	52.2	17.7	139.2	
Mooneye	No.	9	37	96	104	55	2	303	20.9
(*Hiodon tergisus*)	kg.	3.5	11.4	33.8	40.8	25.2	1.0	115.7	
Tullibee	No.	8	30	61	39	49	10	197	13.6
(*Coregonus artedii*)	kg.	1.5	10.7	28.1	19.8	29.3	6.5	95.9	
Yellow perch	No.	4	32	34	9	-	-	79	5.4
(*Perca flavescens*)	kg.	0.6	5.6	10.4	2.6	-	-	19.2	
Burbot	No.	1	-	2	-	-	1	4	0.3
(*Lota lota*)	kg.	0.2	-	1.6	-	-	1.3	3.1	
Shorthead redhorse	No.	-	1	2	2	2	4	11	0.7
(*Moxostoma macrolepidotum*)	kg.	-	0.9	1.8	2.5	2.2	5.8	13.2	
Total	No.	122	273	523	300	192	38	1448	
	kg.	58.8	116.8	269.4	181.8	168.9	54.3	850.0	

Table 8. Gill net summary Wrong Lake.

Species		Mesh Size (cm) 3.81	5.08	7.62	9.52	10.79	12.70	Total	%
Walleye (*Stizostedion vitreum*)	No.	35	98	214	141	80	18	586	51.3
	kg.	17.7	57.6	139.5	104.7	71.6	18.4	409.5	
Northern pike (*Esox lucius*)	No.	4	13	25	8	9	3	62	5.4
	kg.	5.8	16.7	48.0	16.2	20.7	5.8	113.2	
Sauger (*Stizostedion canadense*)	No.	2	20	8	-	-	-	30	2.6
	kg.	0.6	5.8	3.2	-	-	-	9.6	
Whitefish (*Coregonus clupeaformis*)	No.	1	-	7	1	7	6	22	1.9
	kg.	0.4	-	5.1	1.4	5.0	9.9	21.8	
Shorthead redhorse (*Moxostoma macrolepidotum*)	No.	-	-	4	2	3	-	9	0.8
	kg.	-	-	4.3	2.2	5.2	-	11.7	
White sucker (*Catostomus commersoni*)	No.	-	-	4	4	13	22	43	3.8
	kg.	-	-	5.0	4.8	17.7	33.8	61.3	
Tullibee (*Coregonus artedii*)	No.	13	60	91	47	62	25	298	26.1
	kg.	1.9	15.7	47.4	26.3	37.8	17.4	146.5	
Yellow perch (*Percal flavescens*)	No.	48	34	8	3	-	-	93	8.1
	kg.	3.0	4.6	2.0	0.5	-	-	10.1	
TOTAL	No.	103	225	361	206	174	74	1143	
	kg.	29.4	100.4	254.5	156.1	158.0	85.3	783.7	

Stomach contents

The stomach contents of the sport species, walleye and northern pike, were examined to obtain information on diet. The walleye and sauger of Harrop Lake contained digested fish remains. Only two fish contained digested invertebrate remains. The northern pike of Harrop Lake contained partially digested crayfish and some digested fish remains. Pike and walleye from Eardley, Weaver and Wrong lakes showed a similar predominance of digested fish remains.

There was no stomach content analysis done on the other species captured during this survey.

Walleye age and growth

The growth of the walleye sampled from each lake, in terms of length and weight, is shown in Figs. 11 and 12 respectively. The interval about the curves is plus and minus one standard error (± 1SE).

The linear regressions describing the age-specific mean fork length to age relationships for walleye growth in the study lakes is presented in Table 9.

The age-frequency distribution of the walleye sampled is illustrated in Fig. 13. Age classes 2 to 23 are represented.

The length-weight relationship of the walleye sampled is shown in Fig. 14. The equations for the linear regressions describing each relationship are presented in Table 10.

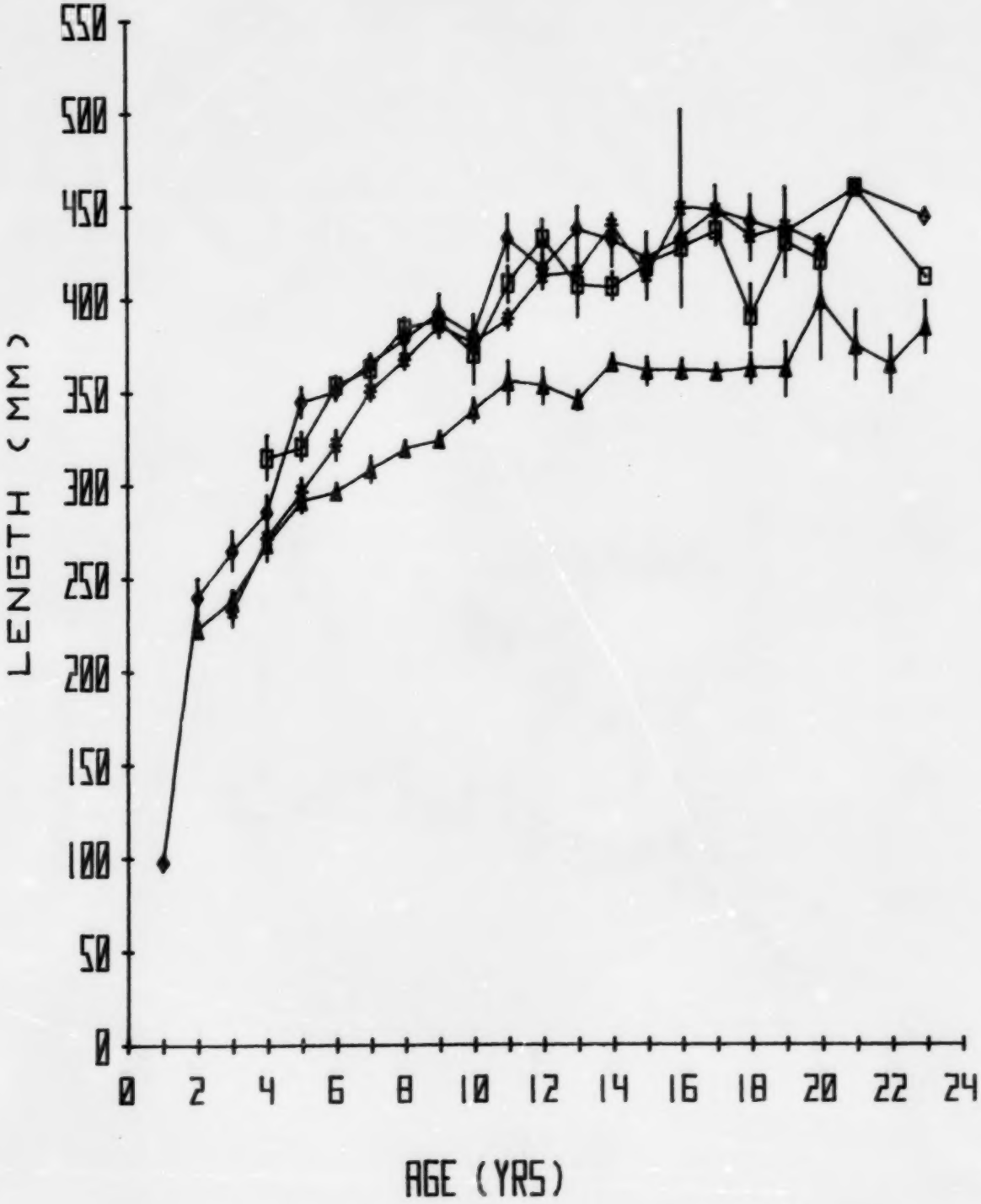


Fig. 11. Length-age relationship and standard error of means of walleye from the lakes surveyed. (Harrop * Eardley ◇ Weaver △ Wrong □).

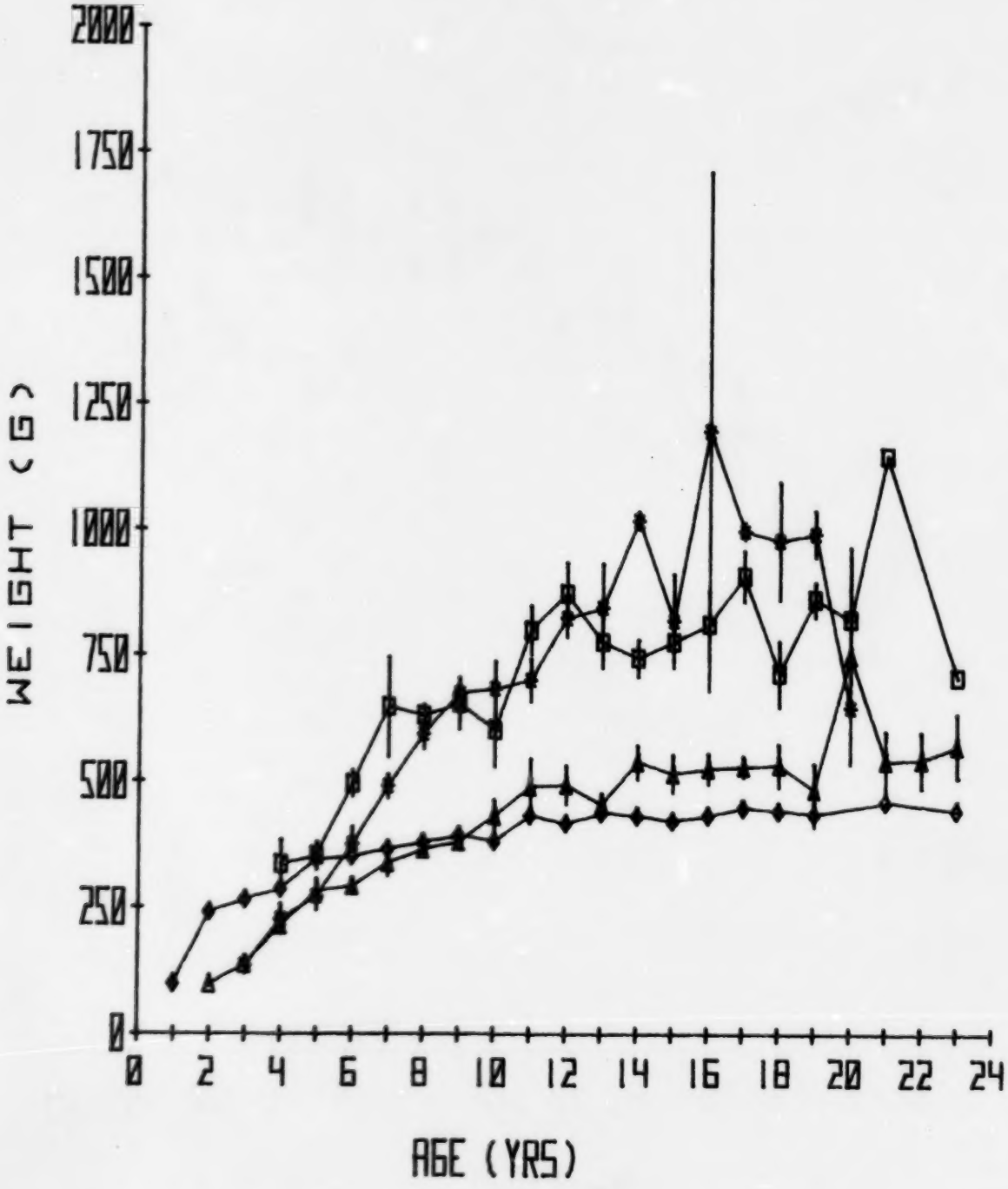


Fig. 12. Weight-age relationship and standard error of means of walleye from the lakes surveyed. (Harrop * Eardley ◇ Weaver △ Wrong □).

Table 9. Linear regressions describing the growth curves of walleye from the study lakes.

Lake	Curve	Linear equation	Correlation coefficient	Test F value	d,f.	Significance at P=0.05
Harrop	Age 3-9	Log_e length = 4.958 + 0.458 Log_e age	0.998	1941.41	1,5	significant
Eardley	Age 1-9	Log_e length = 4.828 + 0.573 Log_e age	0.948	62.24	1,7	significant
Weaver	Age 2-9	Log_e length = 5.210 + 0.270 Log_e age	0.989	275.04	1,6	significant
Wrong	Age 4-9	Log_e length = 5.338 + 0.288 Log_e age	0.978	89.34	1,4	significant

Table 10. Length-weight relationship of walleye from Harrop, Eardley, Weaver and Wrong lakes.

Lake	Length-weight equation	Correlation coefficient	Test F value	d,f.	Significance at P=0.05
Harrop	Log_e weight = -12.357 + 3.165 Log_e length	0.984	5464.73	1,178	significant
Eardley	Log_e weight = -12.168 + 3.123 Log_e length	0.985	7472.02	1,228	significant
Weaver	Log_e weight = -11.104 + 2,942 Log_e length	0.936	2792.60	1,392	significant
Wrong	Log_e weight = -10.712 + 2.878 Log_e length	0.954	2674.92	1,262	significant

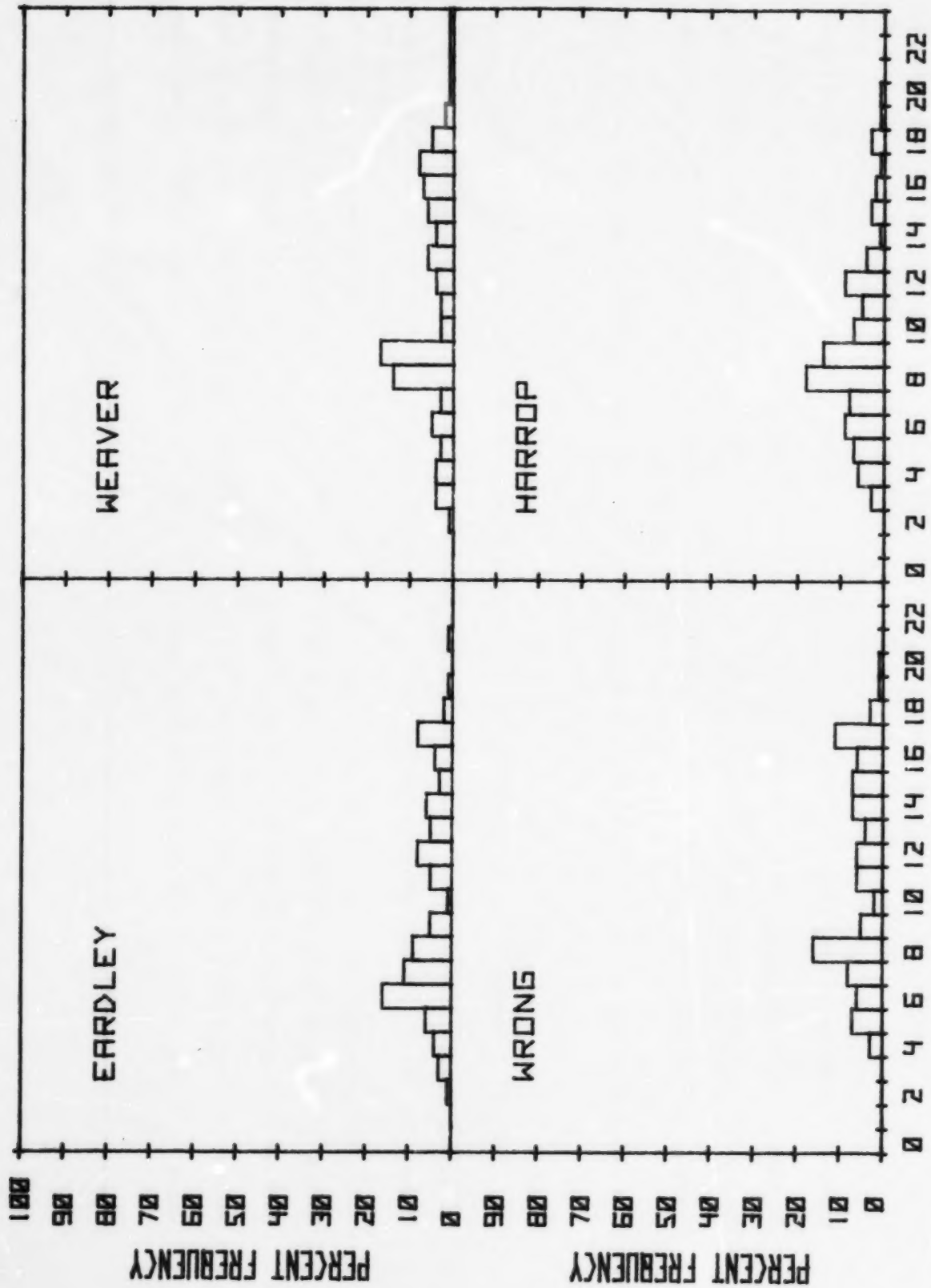


Fig. 13. Age-frequency distribution of walleye from Harrop, Eardley, Weaver and Wrong lakes

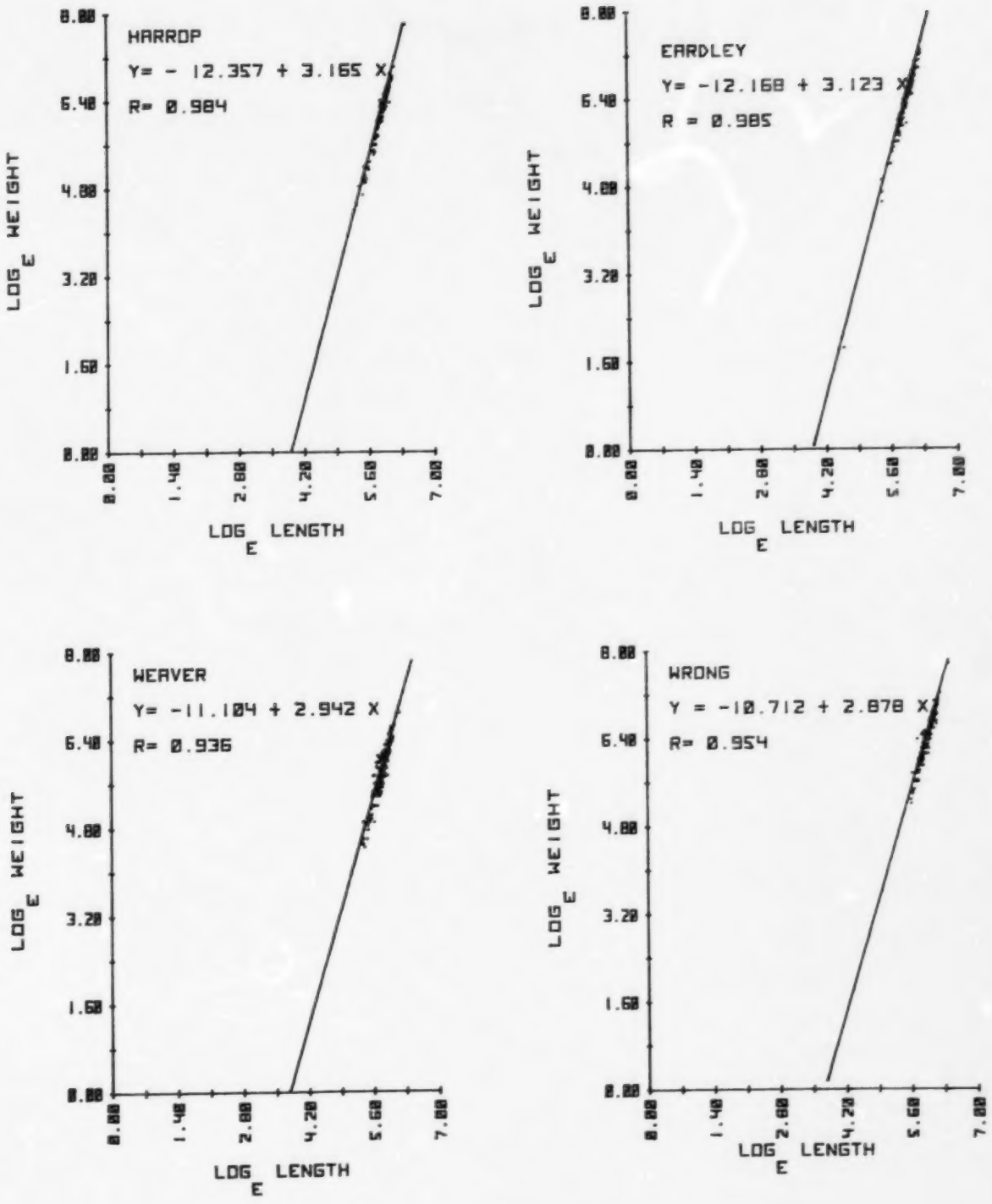


Fig. 14. Length-weight relationship of walleye from Harrop, Eardley, Weaver and Wrong lakes.

The condition factors for the walleye sampled from each lake are presented in Table 11.

Table 11. Condition factors of walleye from the lakes surveyed (sample size in parenthesis).

Age	Harrop July 27-30, 1978	Eardley August 13-16, 1978	Weaver August 20-24, 1978	Wrong August 4-7, 1978
1	-	0.74 (1)	-	-
2	-	0.82 (1)	0.89 (2)	-
3	1.07 (6)	1.00 (4)	1.03 (15)	-
4	1.10 (10)	1.06 (10)	1.10 (16)	1.03 (8)
5	1.02 (12)	1.07 (14)	1.12 (11)	1.04 (18)
6	1.09 (16)	1.08 (38)	1.12 (19)	1.11 (17)
7	1.12 (14)	1.10 (27)	1.11 (14)	1.36 (21)
8	1.17 (32)	1.09 (20)	1.11 (54)	1.13 (43)
9	1.17 (25)	1.07 (12)	1.10 (68)	1.09 (14)
10	1.25 (13)	0.94 (2)	1.08 (11)	1.17 (6)
11	1.18 (16)	1.09 (11)	1.06 (10)	1.19 (17)
12	1.17 (16)	1.11 (20)	1.07 (16)	1.06 (16)
13	1.16 (7)	1.10 (13)	1.09 (25)	1.25 (10)
14	1.20 (1)	1.05 (13)	1.08 (17)	1.10 (19)
15	1.15 (5)	1.11 (7)	1.06 (23)	1.05 (20)
16	1.11 (4)	1.08 (10)	1.08 (26)	1.01 (16)
17	1.11 (1)	1.12 (18)	1.12 (30)	1.08 (29)
18	1.17 (6)	1.17 (4)	1.08 (20)	1.19 (9)
19	1.18 (2)	1.24 (3)	1.00 (6)	1.09 (4)
20	0.82 (1)	-	1.10 (3)	1.10 (2)
21	-	1.07 (2)	1.03 (3)	1.18 (1)
22	-	-	1.12 (2)	-
23	-	0.82 (1)	1.00 (3)	1.02 (1)
Avg.	1.14 (180)	1.09 (230)	1.09 (394)	1.12 (271)

The maturity data for the walleye from the study lakes are presented in Table 12.

Table 12. Maturity data for walleye from the study lakes.

	Harrop	Eardley	Weaver	Wrong
Sex ratio (male:female)	1:4.8	1:3.1	1:2.6	1:5.6
Percent mature males	51.6	51.7	91.7	70.7
Mean Length mature males	365.4	381.4	327.6	384.5
Percent mature females	73.2	71.5	84.3	86.1
Mean Length mature females	388.6	419.7	348.5	407.9
Z	6.8	7.1	6.2	6.8
Age at 100% maturity	13	10	10	11
Mean Length at 100% maturity	415	381	341	409
Mean age of sample	9.1	10.1	11.1	11.2

The percentage of mature males varied from 51.6 percent mature in Harrop Lake to 91.7 percent mature in Weaver Lake. The occurrence of mature females ranged from 71.5 percent in Eardley Lake to 86.1 percent in Wrong Lake. The mean weighted age of onset of sexual maturity (Z) ranged from 6.2 years in Weaver Lake to 7.1 years in Eardley Lake. The mean age of the catches ranged from 9.1 years in Harrop Lake to 11.2 years in Wrong Lake.

Northern pike age and growth

The growth of northern pike from the study lakes, in terms of length and weight, is presented in Figs. 15 and 16. The interval about the curves is plus and minus one standard error (± 1SE).

The linear regressions describing the age-specific mean length to age relationships of northern pike growth are given in Table 13.

The age-frequency distribution of northern pike sampled is illustrated in Fig. 17. The majority of northern pike were from age groups 6, 7 and 8.

The length-weight relationships of northern pike from each lake are shown in Fig. 18. The equations for the linear regressions are summarized in Table 14.

The condition factors from the length-weight data for the northern pike sampled are presented in Table 15.

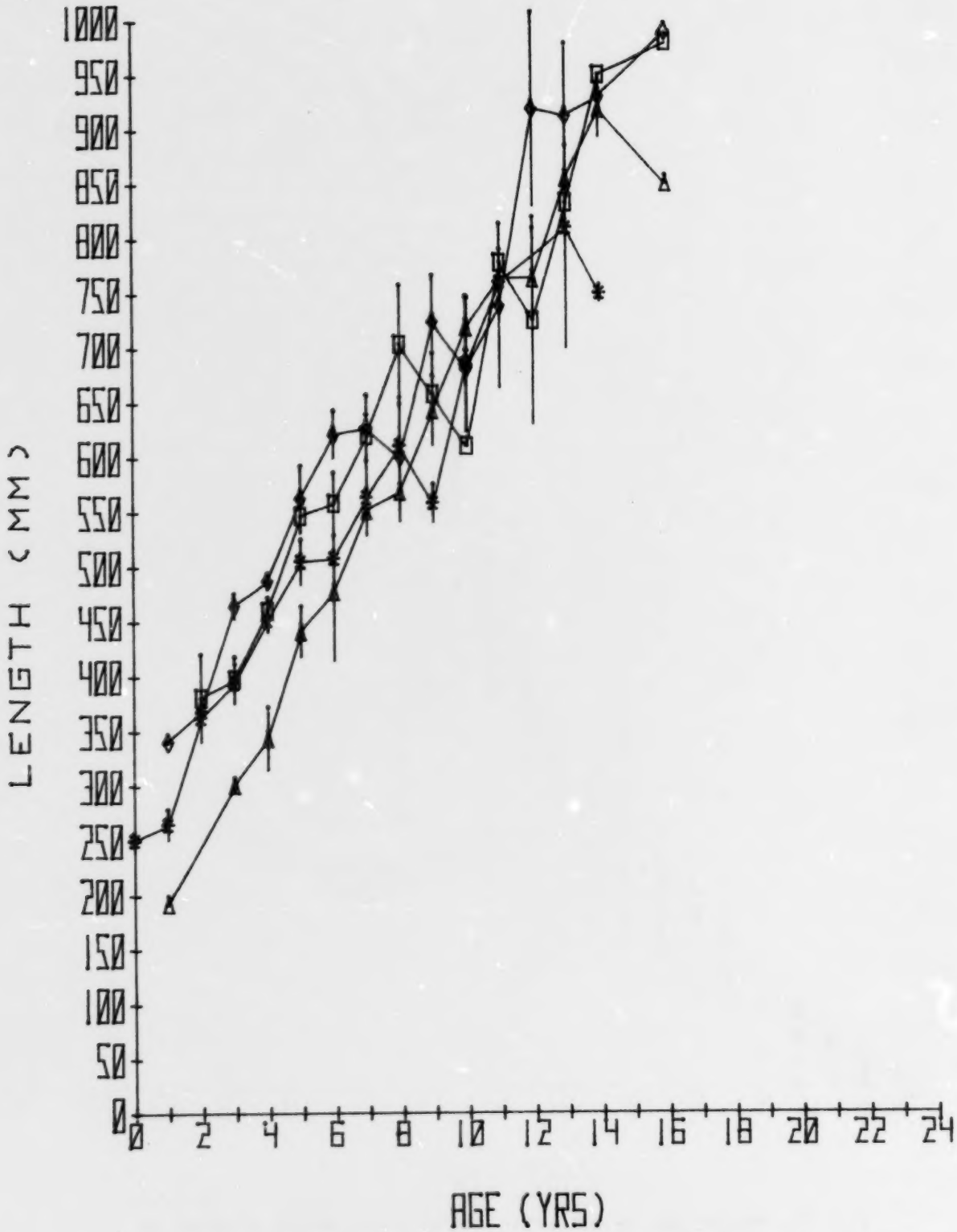


Fig. 15. Length-age relationship and standard error of means of northern pike from the study lakes.(Harrop * Eardley ◇ Weaver △ Wrong □).

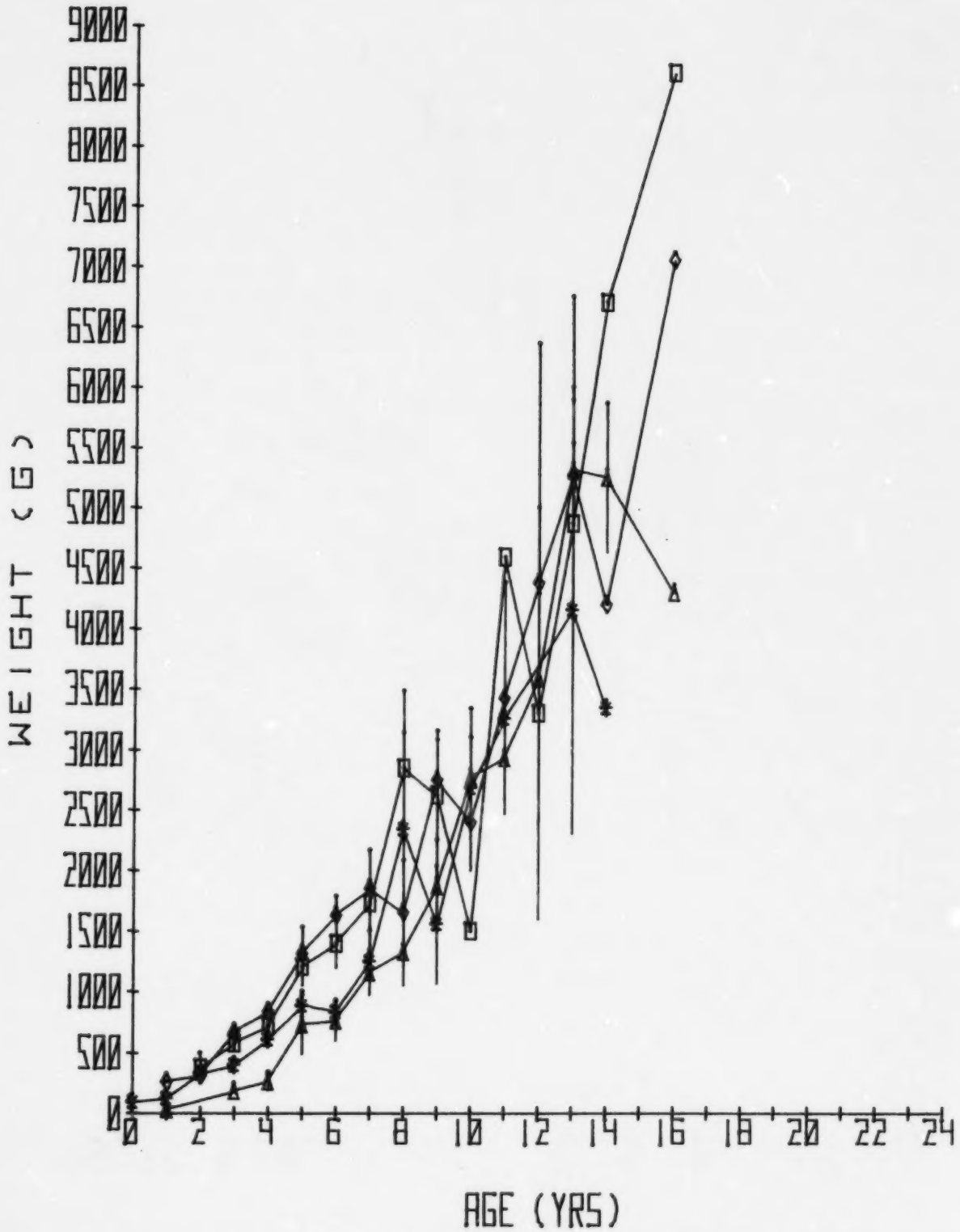


Fig. 16. Weight-age relationship and standard error of means of northern pike from the study lakes.(Harrop * Eardley ◇ Weaver △ Wrong □).

Table 13. Linear regressions describing the growth curves of northern pike from the study lakes.

Lake	Curve	Linear Equation	Correlation Coefficient	Test F value	d.f.	Significance at P=0.05
Harrop	Age 1-11	Log_e length = 5.569 + 0.399 Log_e age	0.981	225.05	1,9	significant
Eardley	Age 1-14	Log_e length = 5.704 + 0.397 Log_e age	0.965	164.90	1,12	significant
Weaver	Age 1-14	Log_e length = 5.116 + 0.616 Log_e age	0.987	415.06	1,11	significant
Wrong	Age 2-14	Log_e length = 5.555 + 0.443 Log_e age	0.959	129.09	1,11	significant

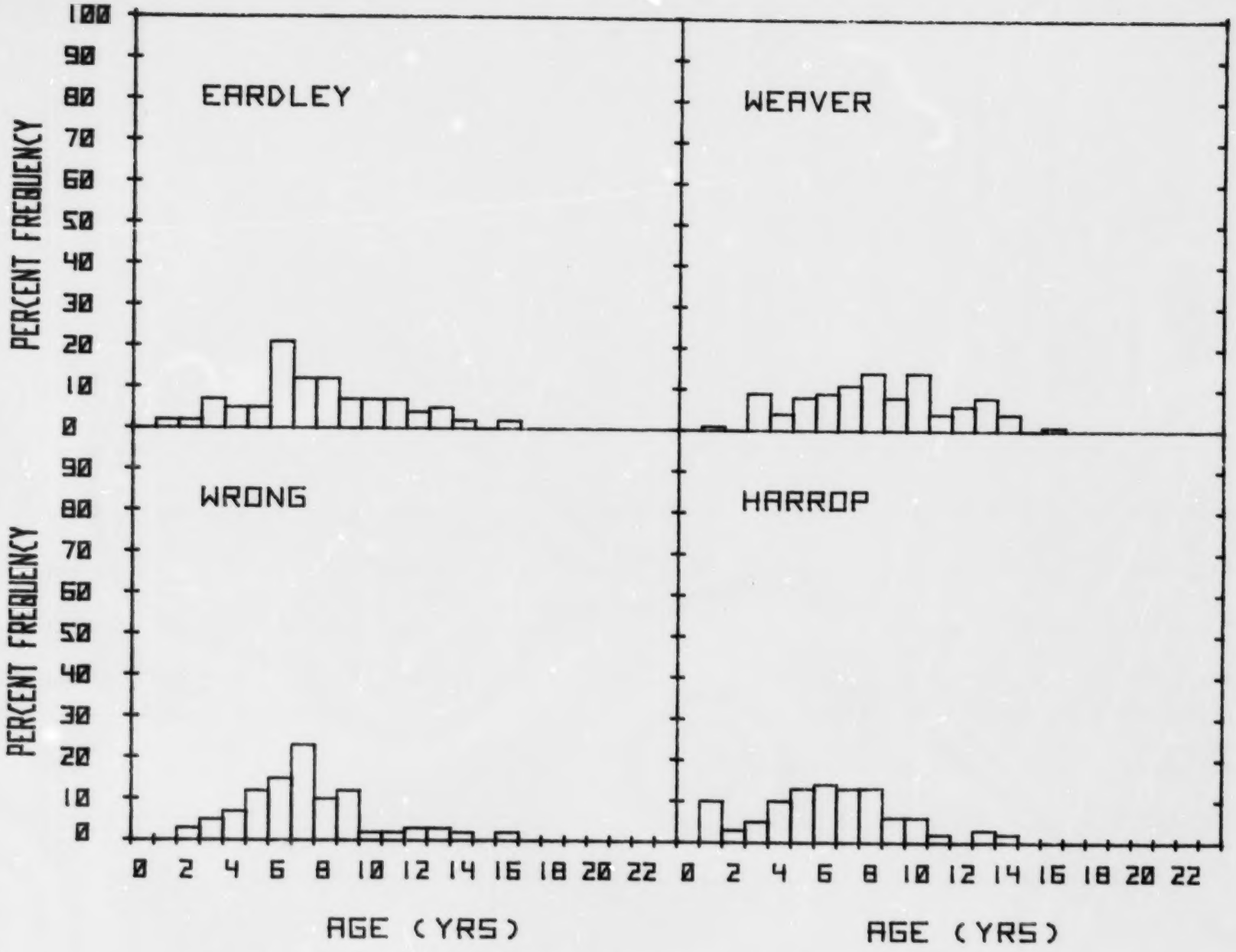


Fig. 17. Age-frequency distribution of northern pike from the study lakes

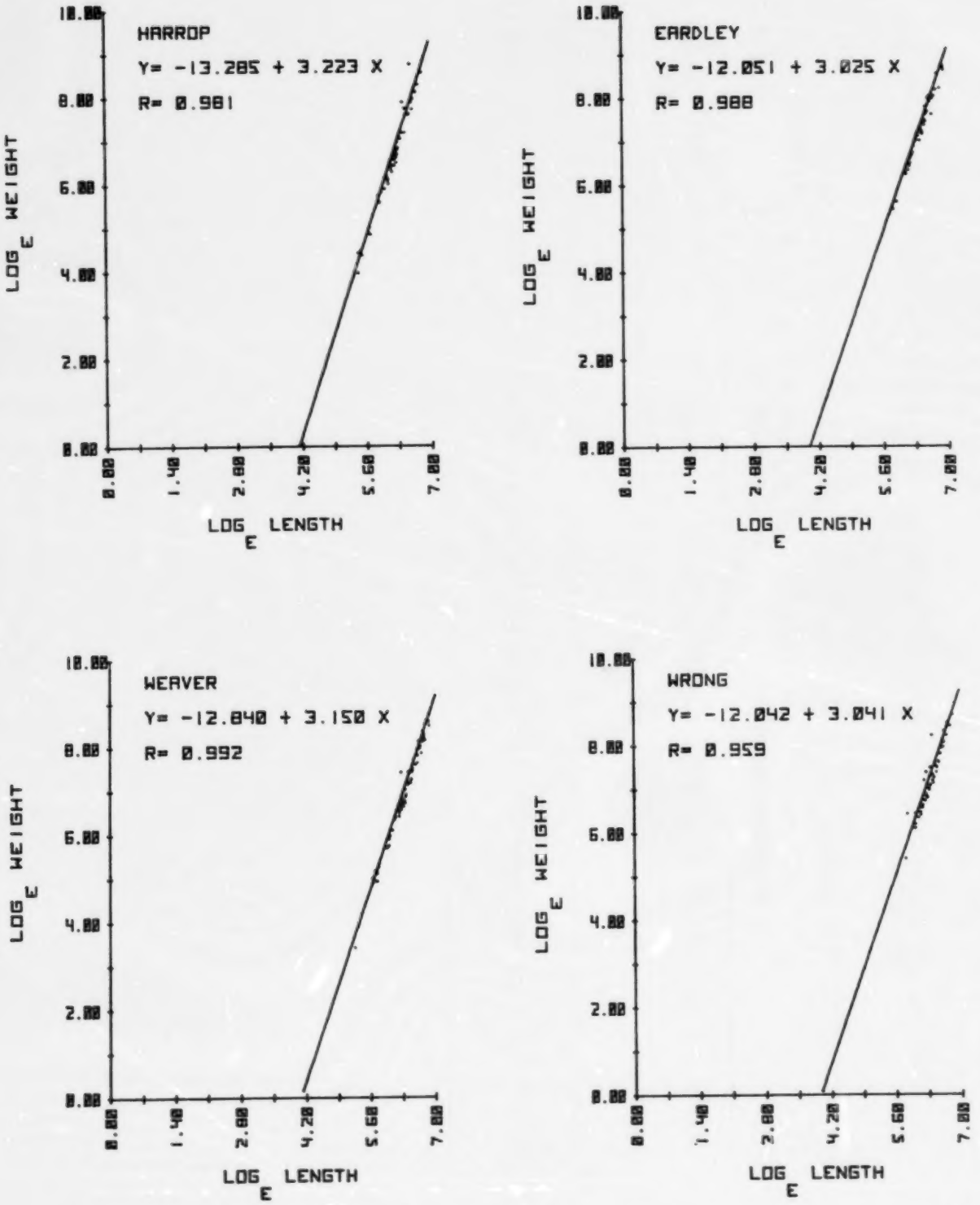


Fig. 18. Length-weight relationship of northern pike from Harrop, Eardley, Weaver and Wrong lakes.

Table 14. Length-weight relationship of northern pike from Harrop, Eardley, Weaver and Wrong lakes.

Lake	Length-weight equation	Correlation coefficient	Test F value	d.f.	Significance at P=0.05
Harrop	Log_e weight = -13.285 + 3.223 $\log_e$ length	0.981	1594.71	1,61	significant
Eardley	Log_e weight = -12.051 + 3.025 $\log_e$ length	0.988	2147.93	1,54	significant
Weaver	Log_e weight = -12.840 + 3.150 $\log_e$ length	0.992	4567.68	1,77	significant
Wrong	Log_e weight = -12.042 + 3.041 $\log_e$ length	0.959	649.68	1,57	significant

Table 15. Condition factors of northern pike from the lakes surveyed (sample size in parenthesis)

Age	Harrop July 27-30, 1978	Eardley August 13-16, 1978	Weaver August 20-24, 1978	Wrong August 4-7, 1978
0	0.58 (1)	-	-	-
1	0.63 (6)	0.66 (1)	0.49 (1)	-
2	0.69 (2)	0.62 (1)	-	0.66 (2)
3	0.64 (3)	0.67 (4)	0.69 (7)	0.99 (3)
4	0.65 (6)	0.73 (3)	0.62 (3)	0.75 (4)
5	0.66 (8)	0.72 (3)	0.76 (6)	0.72 (7)
6	0.61 (9)	0.66 (12)	0.65 (7)	0.78 (9)
7	0.65 (8)	0.71 (7)	0.66 (9)	0.73 (13)
8	0.83 (8)	0.68 (7)	0.66 (11)	0.74 (6)
9	0.84 (4)	0.71 (4)	0.66 (6)	0.91 (7)
10	0.80 (4)	0.74 (4)	0.71 (11)	0.66 (1)
11	0.74 (1)	0.77 (4)	0.66 (3)	0.97 (1)
12	-	0.52 (2)	0.77 (5)	0.78 (2)
13	0.72 (2)	0.64 (3)	0.83 (6)	0.84 (2)
14	0.79 (1)	0.52 (1)	0.67 (3)	0.78 (1)
15		-	-	-
16		0.73 (1)	0.70 (1)	0.91 (1)
AVG.	0.69 (63)	0.68 (57)	0.69 (79)	0.78 (59)

The maturity data for northern pike from the study lakes is summarized in Table 16.

Table 16. Maturity data for northern pike from the study lakes.

	Harrop	Eardley	Weaver	Wrong
Sex ratio (male:female)	1:2.9	1:4.6	1:4.1	1:1.6
Percent mature males	50.0	70.0	80.0	82.6
Mean Length mature males	538.1	660.3	537.3	621.8
Percent mature females	73.9	93.5	87.1	80.6
Mean Length mature females	576.2	664.7	672.6	658.6
$\bar{z}$	4.4	3.5	4.9	4.9
Mean age of sample	6.2	7.6	8.2	7.1

Harrop Lake had the lowest frequency of mature males at 50.0 percent, Wrong Lake had the greatest frequency of mature males with 82.6 percent. The frequency of mature females ranged from 73.9 percent in Harrop Lake to 93.5 percent in Eardley Lake. The mean weighted age of the onset of sexual maturity ranged from 3.5 years in Eardley Lake to 4.9 years in Weaver and Wrong lakes. The mean age of the pike sampled ranged from 6.2 years in Harrop Lake to 8.2 years in Weaver Lake.

Production potential

The MEI (Ryder, 1965) has been applied to the morphometric and edaphic properties of the lakes to provide an estimate of the maximum sustained yield (MSY) in kg/ha/yr (Table 17). The mean depth of Harrop and

Weaver lakes is less than the minimum for accurate application of the equation Ryder et al.(1974). The results for these lakes should therefore be interpreted with caution.

Table 17. MEI and estimated production potential (MSY) for the lakes surveyed.

Lake	Mean depth (m)	TDS (mg/1)	MEI	Production potential (kg/ha/yr)
Harrop	2.1	51.0	23.7	6.2
Eardley	4.0	49.0	12.2	4.5
Weaver	2.0	58.5	28.9	6.8
Wrong	3.7	71.0	18.9	5.6

DISCUSSION

Inflow and outflow

Tributary streams and rivers exert a major influence on the community dynamics of the fisheries resource of a lake. They provide spawning, nursery and feeding areas for walleye, northern pike, suckers and various minnow species. Absence of suitable tributaries with spawning areas for these species restricts their distribution and abundance. The walleye and northern pike under such circumstances are forced to seek suitable habitat within the lake itself for spawning and nursing activities. Walleye characteristically spawn in the gravel bottom areas of tributary streams. In the absence of stream spawning areas they will also spawn in the boulder to coarse gravel shoals of lakes. Northern pike spawn on heavily vegetated flood plains of rivers and tributary streams and in the weedy marshes and shallow bays of lakes.

Observations of tributaries and littoral habitat of the study lakes indicate no shortage of suitable habitat exists for the sport species.

Physical and chemical parameters

Temperature and dissolved oxygen are major limiting factors to the distribution and abundance of fish, with each species having a preferred temperature range for optimum growth. At the upper and lower limits of their preferred temperature range decreased metabolic activity reduces growth rates. The short growing season of this area (June to September) also restricts growth. The temperature profiles recorded for the lakes (Fig. 6) were very close to the lower limit of 20°C., the physiological optimum described by Hokanson

(1977) for temperate mesotherm fishes. It would appear, therefore, that the short growing season of the area would have a greater effect on the growth of the fish than summer extremes of water temperature.

Analysis of the water chemistry data from the lakes showed little difference among the lakes (Table 3). The ionic composition of the water of these lakes is similar to that described by Armstrong and Schindler (1971) for dilute Canadian Shield lakes.

Fisheries resource

The coefficient of condition or condition factor describes the length-weight relationship or body condition of the fish. This relationship varies according to gonadal condition, fullness of the gut, the amount of fat reserve and the degree of muscular development. Average condition factors for walleye from these lakes (Table 11) were similar to those of walleye from other Precambrian lakes on the east side of Lake Winnipeg, (Hagenson and O'Connor, 1979 and Hagenson and O'Connor, 1980), indicating the quality of the environment of these Precambrian lakes for walleye is similar.

The length-weight regressions (Table 10) describing the length-weight relationship show the walleye stocks in Weaver and Wrong lakes have significantly lower slopes, 2.94 and 2.87, than walleye from Harrop and Eardley, 3.16 and 3.12, respectively. The negatively allometric growth of walleye in Weaver and Wrong can probably be attributed to the lower level of exploitation of the walleye stocks. Weaver Lake has not been developed to any degree and at the time of this survey Thunderbird Lodge on Wrong Lake had only been fully operational for about one year. It would appear therefore that the levels of exploitation on Weaver and Wrong lakes have not yet stimulated compensatory growth responses to fishing pressure.

An analysis of variance of the linear regressions describing the growth curves for walleye (Table 9) indicate the growth rate to be the same in Harrop and Eardley lakes. The elevation of the curves is also the same. The growth of walleye from Wrong Lake is the same as that for walleye from unexploited Weaver Lake. However, the elevation of the curve of walleye from Wrong Lake is the same as the elevation of the curves for Harrop and Eardley walleye. The walleye from Wrong Lake have a faster rate of growth in the first three years; these year classes are not represented in these calculations. The average size of four year old walleye from Wrong Lake is greater than that of walleye from nine other east side lakes, Table 18. Therefore, because ages 1-3 were not included in the growth curve, the slope of the linear regressions describing the growth of walleye on Wrong Lake, 0.288, is unrepresentative of the actual growth rate.

It has been documented by Spangler et al.(1977) that the most conspicuous responses of percid communities to exploitation are changes in variability of recruitment, increased growth rate and reduction in the ages of first spawning.

The calculated mean weighted age of the onset of sexual maturity for walleye from the study lakes was between 6 and 7 years for each lake. There is a definite decline in the growth rate after this age (Fig. 11). The calculated asymptotic lengths for the study lakes were Harrop, 437 mm, Eardley 428 mm, Weaver 377 mm and Wrong 411 mm (Fig. 19 and Table 19). These values are very close to the mean lengths at 100 percent maturity which were Harrop 415 mm at age 13, Eardley 381 mm at age 10, Weaver 341 mm at age 10 and Wrong 409 mm at age 11. There is little increase in length after these ages. (Fig. 11). This conforms to the findings of Power (1978) who stated the growth of Arctic fish populations is relatively rapid until first maturity,when it becomes slow through a life span that may exceed

Table 18. Age-specific mean lengths of walleye in Precambrian Shield lakes.

	Fork length in mm at age																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Harrop	-	-	233	272	297	322	351	368	386	376	390	412	415	440	413	449	448	434	439	430							
Eardley	98	230	270	286	340	354	366	379	393	381	433	416	438	440	422	433	448	442	436	-	460	-	444				
Weaver	-	222	238	269	292	297	314	319	325	341	356	355	346	366	362	362	361	363	363	400	375	365	385				
Wrong	-	-	-	315	321	354	363	385	389	371	409	432	408	407	419	428	437	391	430	421	460	-	412				
Dogskin[1]	-	192	235	272	304	331	370	380	371	415	446	489	475	-	533	512	562	390	510	380	456						
Family[1]	-	-	200	273	313	332	354	387	386	398	412	426	398	419	440	401	406	-	-	-	-	420	405				
Viking[1]	-	206	292	-	332	-	372	379	385	431	405	438	-	390	418	425	472	385	-	-	440	-	412				
Vickers[1]	-	185	214	255	279	343	369	401	424	420	424	420	440	442	503	355											
Obukowin[2]	-	-	234	246	344	341	342	354	356	362	354	363	361	348	374	369	366	366	370								
Aikens[2]	-	-	-	270	344	349	409	441	452	-	462	410	-	480	-	-	-	-	-	-	-	-	-	-	490	-	635

[1]Hagenson and O'Connor, 1980.

[2]Hagenson and O'Connor, 1979.

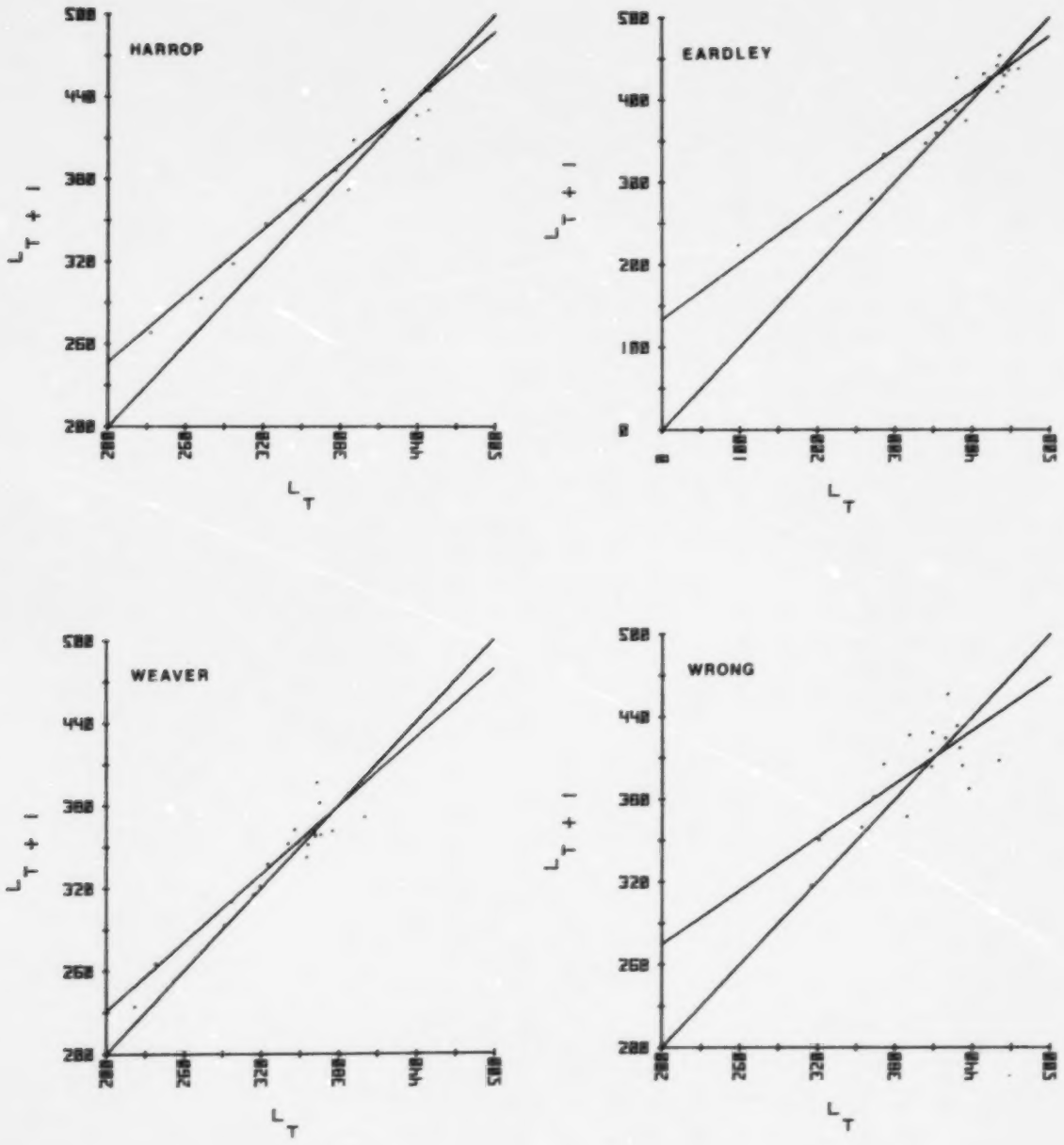


Fig. 19. Walford plots of walleye from Harrop, Eardley, Weaver and Wrong lakes.

Table 19. Linear equations of Walford plots for walleye fitted by least squares regression.

Lake	Linear equation	L_∞ (mm)	Correlation coefficient	Test F value	d.f.
Harrop	$L_{t+1} = 86.794 + 0.802\ L_t$	437	0.967	214.10	1,15
Hardley	$L_{t+1} = 133.818 + 0.688\ L_t$	428	0.958	201.73	1,18
Weaver	$L_{t+1} = 66.169 + 0.825\ L_t$	377	0.952	172.26	1,18
Wrong	$L_{t+1} = 145.552 + 0.647\ L_t$	411	0.752	20.83	1,16

Table 20. Age-specific mean lengths of northern pike in Precambrian Shield lakes

	Fork length in mm at age															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Harrop	264	362	393	451	504	507	563	610	557	684	760	--	810	750	--	--
Eardley	340	368	464	487	562	621	626	600	724	681	739	919	912	930	--	990
Weaver	192	--	300	343	441	477	551	568	643	719	763	763	855	919	--	850
Wrong	--	380	397	459	546	557	618	703	657	610	778	725	832	950	--	980
Dogskin[1]	--	--	440	497	549	594	636	665	650	805	--	--	--	--	--	--
Family[1]	--	383	448	473	501	567	590	608	648	760	--	--	--	--	--	--
Viking[1]	--	408	457	451	485	569	683	690	813	763	--	826	1000	--	--	--
Obukowin[2]	--	375	399	436	478	628	730	610	--	--	--	--	--	--	--	--
Aikens[2]	--	--	490	589	597	611	--	778	--	--	--	--	--	--	--	--

[1]Hagenson and O'Connor, 1980.

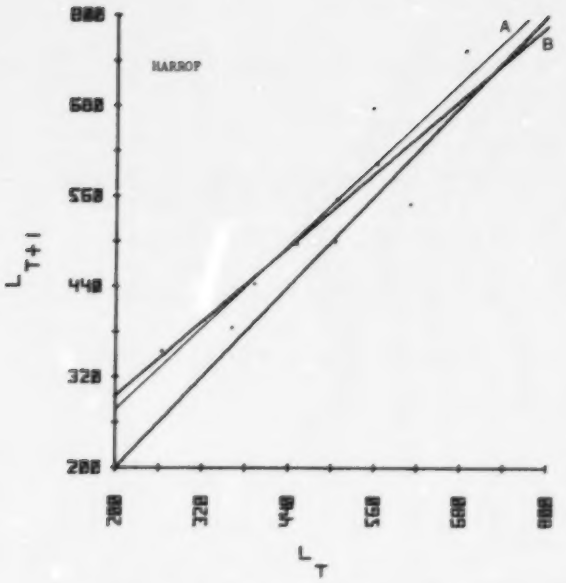
[2]Hagenson and O'Connor, 1979.

50 years and mortality declines rapidly through early life and stabilizes at a very low level through much of the life span. The age-frequency distribution for walleye from Harrop, Eardley, Weaver and Wrong lakes (Fig. 13) conforms to this hypothesis.

Kelso and Ward (1977) found a stability of biomass in unexploited percid communities. Adams and Olver (1977) showed the ratio of percid yield to total yield was independent of lake area and productivity which suggested a relatively stable equilibrium in a percid community under exploitation. Analysis of commercial catches from northwestern Ontario lakes showed that approximately one-third of the total yield (by weight) was percids. The average percid yield (by weight) in the study lakes was 45.7 percent of the total yield, which is considerably higher than percid yields in northwestern Ontario lakes. However, when the yield of the small mesh test nets, less than legal commercial size, is deleted from the total percid yield the average then becomes 34.3 percent, which is very close to the percid yield in northwestern Ontario lakes. Walleye were the dominant percid in each of the study lakes.

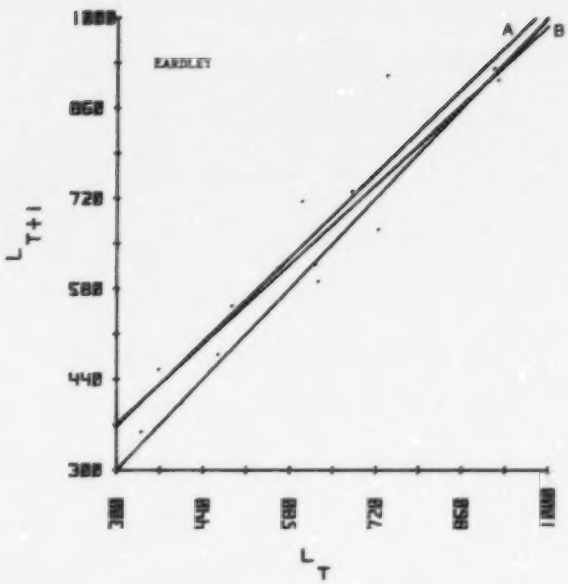
Condition factors of northern pike from Harrop, Eardley, Weaver and Wrong lakes (Table 15) were very similar to values obtained for northern pike from other Precambrian lakes (Hagenson and O'Connor, 1979 and Hagenson and O'Connor, 1980).

The length-weight relationship of northern pike from the study lakes, Fig. 18 and Table 14 shows a considerable range in growth with the slope ranging from 3.025 in Eardley Lake to 3.223 in Harrop Lake.



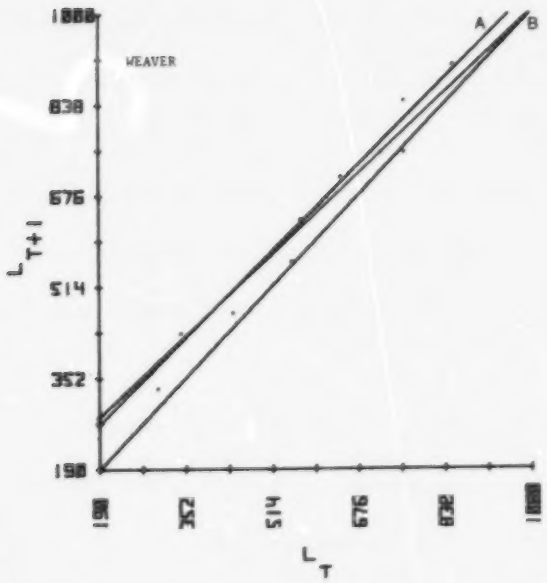
A - L_∞ = 1058 mm with all points included in regression

B - L_∞ = 724 mm last point deleted



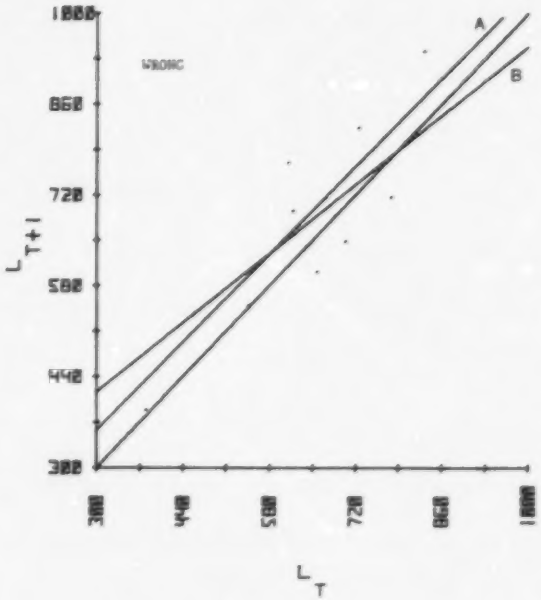
A - L_∞ = 1270 mm with all points included in regression

B - L_∞ = 895 mm length at L_c = 739 mm deleted



A - L_∞ = 1690 mm with all points included in regression

B - L_∞ = 1011 mm last two points deleted



A - L_∞ = 2000 mm with all points included in regression

B - L_∞ = 786 mm first and last points deleted

Fig. 20. Walford plots of northern pike from Harrop, Eardley, Weaver and Wrong lakes.

Table 21. Linear equations of Walford plots of northern pike fitted by least squares regression.

Lake	Linear equation	L_∞	Correlation coefficient	Test F value	d.f.
Harrop	$L_{t+1} = 92.186 + 0.913\ L_t$ 1	1058	0.920	44.39	1,8
	$L_{t+1} = 131.757 + 0.818\ L_t$ 2	724	0.885	25.46	1,7
Eardley	$L_{t+1} = 88.460 + 0.930\ L_t$ 1	1270	0.939	82.70	1,11
	$L_{t+1} = 106.762 + 0.881\ L_t$ 3	895	0.964	132.66	1,10
Weaver	$L_{t+1} = 89.720 + 0.947\ L_t$ 1	1690	0.987	395.27	1,10
	$L_{t+1} = 112.906 + 0.888\ L_t$ 4	1011	0.986	275.49	1,8
Wrong	$L_{t+1} = 67.672 + 0.967\ L_t$ 1	2000	0.889	38.15	1,10
	$L_{t+1} = 188.624 + 0.760\ L_t$ 5	786	0.794	13.66	1,8

1. all points included in regression.
2. L_{10} deleted.
3. L_{11} deleted.
4. L_{11} and L_{12} deleted.
5. L_1 and L_{12} deleted.

A covariance analysis of the linear regressions describing the growth curves of northern pike from the study lakes (Table 13) indicates no significant difference for either growth rate or elevation of the curves for Eardley and Wrong lakes. Harrop Lake northern pike also grow at the same rate, but the elevation of the curve is not as great as that of Eardley and Wrong lakes. Weaver Lake northern pike have the fastest rate of growth and the curve has the highest elevation.

A comparison of age-specific mean lengths of northern pike from Harrop, Eardley, Weaver and Wrong lakes to other Precambrian lakes on the east side of Lake Winnipeg is given in Table 20. The range of values for any given age group is quite large, indicating a great deal of variation in growth rate from lake to lake.

Calculated asymptotic lengths for northern pike from Harrop, Eardley, Weaver and Wrong lakes (Fig. 20 and Table 21) also indicate a great deal of variation in maximum size of northern pike from lake to lake.

The age of attainment of sexual maturity for Harrop, Eardley, Weaver and Wrong northern pike agrees with what has been reported for other areas (Scott and Crossman, 1973 and Franklin and Smith, 1963).

It has been reported by Toner and Tawler (1969) that even when fishing pressure in northern pike populations is low, the total mortality appears to be 50 percent.

Franklin and Smith (1963) concluded that there is no direct relationship between adult abundance and the strength of resulting year classes, therefore, the attainment of sexual maturity at an early age should ensure a significant population of northern pike in these lakes.

An estimate of the optimum sustained angling yield (OSY) for the study lakes was determined from a linear equation of MEI versus angling yield

based on morphoedaphic and creel census data collected from Nutimik, Caddy, White, Betula, Eleanor, Falcon, Brereton, Jessica and Lone Island lakes in the Whiteshell (Fig. 21). The derived metric equation $Y = 0.492 X^{0.673}$ was applied to the morphoedaphic data from the study lakes and the OSY for moderate quality fisheries were calculated (Table 22).

Table 22. Estimated OSY for the study lakes based on moderate quality angling.

Lake	MEI	Estimated OSY (kg/ha/yr)
Harrop	23.4	4.1
Eardley	12.2	2.6
Weaver	28.9	4.7
Wrong	18.9	3.5

The preceding calculations of CSY are based on the moderate quality sport fisheries which exist on developed Whiteshell lakes. A significant portion of the angling fraternity are not satisfied with the fishing opportunities available from these lakes and prefer high quality angling opportunities in a remote wilderness setting of the type that can be found at Harrop, Eardley, Weaver and Wrong lakes.

Angling quality, total domestic, sport and commercial harvest and MSY calculations from Molson and Gods lakes were used to determine that no more than 15 percent of the MSY should be harvested to ensure a sustained high quality sport fishery (Hagenson and O'Connor, 1978). The estimated harvest of the study lakes to maintain high quality angling opportunities

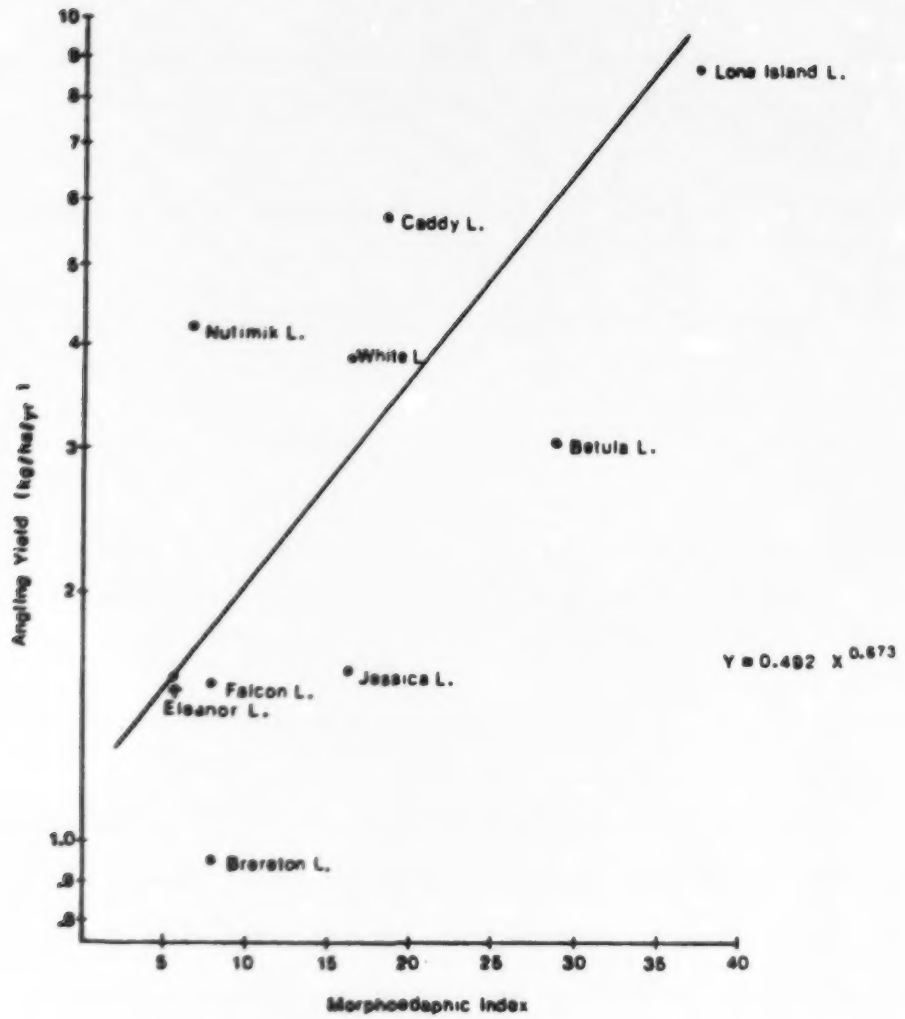


Fig. 21. Angling yield related to the morphoedaphic index for a relatively homogenous group of Precambrian lakes in the Whiteshell Provincial Park.

is given in Table 23. Ontario Ministry of Natural Resources allocated 30 percent of the MSY for commercial lodge development on walleye and pike lakes (Anonymous, 1979). This figure may be appropriate for lodge development on unfished lakes with a moderate quality fishing classification.

Table 23. OSY for the study lakes based on sustained high quality angling.

Lake	MSY (kg/ha/yr)	Maximum Annual Angler Harvest (15% MSY)
Harrop	6.2	0.9
Eardley	4.5	0.7
Weaver	6.8	1.0
Wrong	5.6	0.8

An examination of the Manitoba Master Angler Award records from 1973 to 1979 shows that Harrop produced 11 walleye and 52 northern pike, Eardley produced 9 walleye and 24 northern pike, and Wrong produced 6 walleye and 67 northern pike. No Master Angler awards were recorded from Weaver Lake during this period. The minimum qualifying weight is 3.6 kg for walleye and 9.0 kg for northern pike. It is apparent that the walleye and northern pike populations of Harrop, Eardley and Wrong lakes have some trophy potential.

Management Implications

It would appear that the walleye and northern pike populations of Harrop, Eardley and Wrong lakes offer high quality angling opportunities with some trophy potential. Each of these lakes has been developed to a certain degree.

Harrop Lake has a 16 bed lodge plus 7 privately owned cabins. Eardley Lake has an 8 bed outcamp and 3 private cabins. Wrong Lake has been the most heavily developed with a 24 bed lodge and an 8 bed outcamp. As a result each of the lakes is rather intensively exploited. However, the results of this survey indicate the present level of exploitation has not adversely effected the walleye and northern pike populations of these lakes.

It should be noted, however, that due to the relatively low productivity of these lakes the existing fish stocks may not be able to maintain high quality angling opportunities if the angler harvest were to be increased by further expansion of existing or addition of new facilities. If expansion of existing lodge and outcamp facilities were to increase to the point where the walleye and northern pike populations could no longer maintain high quality angling opportunities the marketability of the operations would be reduced. It would, therefore, be in the best interests of the lodge and outcamp operators to maintain the present capacity of their facilities so that the high quality angling opportunities remain as an attraction to guests.

Weaver Lake is fairly large and relatively shallow with two private cabins located on it. The analysis of the Master Angler Award records indicates there has not been enough angling pressure to determine the trophy potential offered by the walleye and northern pike populations of the lake.

However, the results of this study indicate there is a substantial population of small walleye and some northern pike that should offer reasonably good angling opportunities for an outcamp operation.

Recommendations

1. The capacity of the lodge and outcamp facilities on Harrop, Eardley and Weaver lakes not be increased.
2. In conjunction with restricting further expansion of the lodge and outcamp facilities no further private structures be permitted on Harrop, Eardley and Wrong lakes.
3. Weaver Lake be considered suitable as an outcamp lake.

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Appendix 1. Benthic organisms collected from Harrop, Eardley, Weaver and Wrong lakes.

Benthic organisms	Harrop	Eardley	Weaver	Wrong
MOLLUSCA				
Gastropoda				
Hydrobiidae				
Amnicola	*			
Pelecypoda		*	*	*
ANNELIDA				
Oligochaeta			*	*
ARTHROPODA				
Crustacea				
Branchiopoda				
Cladocera				
Holopedium	*			
Ostracoda	*		*	
Insecta				
Diptera				
Chironomidae	*	*	*	*
Chaoboridae				
Chaoborus	*	*	*	*
Ephemeroptera				
Ephemeridae				
Hexagenia	*	*	*	*
Neuroptera				
Sialidae				
Sialis	*			
Trichoptera				*

Appendix 2. Plankton from Harrop, Eardley, Weaver and Wrong lakes.

Zooplankton	Harrop	Eardley	Weaver	Wrong
ALGAE				
Chlorophyta				
Crucigenia	*			
Micrasterias	*			
Chrysophyta				
Asterionella		*		*
Cyclotella	*			
Fragilaria		*		*
Melosira	*	*		*
Navicula		*		
Surirella				*
Tabellaria	*	*		*
Cyanophyta				
Anabaena	*	*	*	*
Gloeotrichia	*	*	*	
Microcystis	*	*		*
Nostoc				*
Oscillatoria	*			
Pyrrhophyta				
Ceratium	*	*		
ROTATORIA				
Monogononta				
Asplanchna	*	*		
Kellicottia	*		*	*
Ploesoma				*
Polyarthra	*	*		*
Trichocerca	*	*	*	*
CILIOPHORA				
Vorticella				*
ARTHROPODA				
Crustacea				
Branchiopoda				
Cladocera				
Acroperus		*		
Bosmina	*		*	*
Chydorus			*	*
Daphnia	*	*	*	*
Diaphanosoma	*	*	*	*
Holopedium	*	*	*	*
Leptodora	*	*		
Polyphemus	*			
Sida	*		*	
Copepoda				
Cyclops	*	*	*	*
Diaptomus	*	*	*	*
Epischura			*	*
Eucyclops			*	**
Arachnida				
Acarina	*			